Installation Manual
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Micro Motion® Model 1500 and Model 2500

Installation Manual

Micro Motion®

EMERSON™
Process Management

Safety messages

Safety messages are provided throughout this manual to protect personnel and equipment. Read each safety message carefully before proceeding to the next step.

Micro Motion customer service

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Asia	Japan	3 5769-6803	
	All other locations	+65 6777-8211 (Singapore)	
Europe	U.K.	0870 240 1978 (toll-free)	
	All other locations	+31 (0) 318 495 555 (The Netherlands)	

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1 Planning

Topics covered in this chapter:

- *Flowmeter components*
- *Outputs option identification*
- *Environmental limits*
- *Hazardous area classifications*
- *Power requirements*

1.1 Flowmeter components

The transmitter is one component of a Micro Motion flowmeter. The other major component is the sensor.

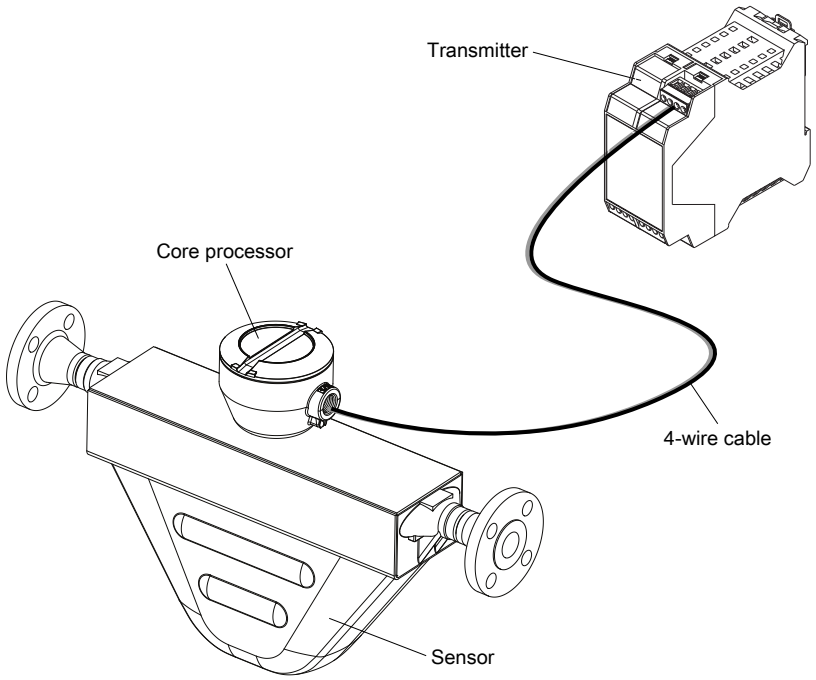
A third component, called the core processor, provides additional memory and processing functions.

1.1.1 Installation types

Model 1500 and Model 2500 transmitters can be installed two different ways, only one of which applies to your specific installation.

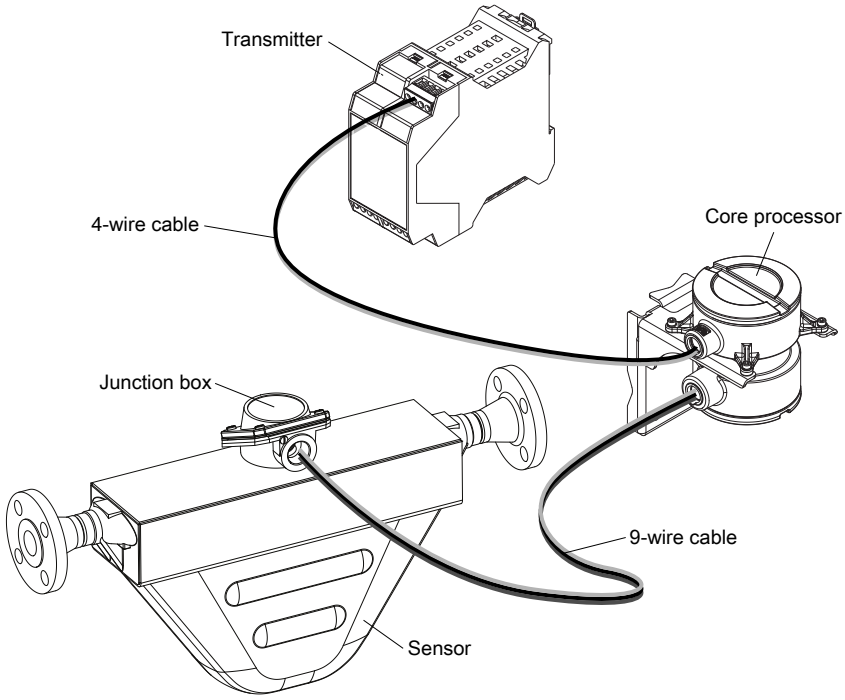
- **4-wire remote** – The transmitter is installed remotely from the sensor. You need to mount the transmitter separately from the sensor, connect a 4-wire cable between the transmitter and sensor, and connect power and I/O wiring to the transmitter.

Figure 1-1: 4-wire remote installation



- **Remote core processor with remote sensor** – A remote core process with remote sensor installation separates all three components – transmitter, core processor, and sensor – all of which are installed separately. A 4-wire cable connects the transmitter to the core processor, and a 9-wire cable connects the core processor to the sensor.

Figure 1-2: Remote core processor with remote sensor installation



1.1.2 Maximum cable lengths

The maximum cable length between flowmeter components that are separately installed is determined by cable type. See *Table 1-1*.

Table 1-1: Maximum cable lengths

Cable type	Wire gauge	Maximum length
Micro Motion 4-wire	Not applicable	1000 ft (300 m)
Micro Motion 9-wire	Not applicable	60 ft (20 m)
User-supplied 4-wire	VDC 22 AWG (0.35 mm^2)	300 ft (90 m)
	VDC 20 AWG (0.5 mm^2)	500 ft (150 m)
	VDC 18 AWG (0.8 mm^2)	1000 ft (300 m)
	RS-485 22 AWG (0.35 mm^2) or larger	1000 ft (300 m)

1.2 Outputs option identification

You must know your transmitter's output option to correctly install the transmitter.

The transmitter's model number is on a tag on the side of the transmitter. You can use the model number to determine the transmitter's output option. The first four characters are the transmitter type. The fifth character is the installation type. The eighth character is the output option. The remaining characters are not relevant to transmitter installation.

Figure 1-3: Model code identification

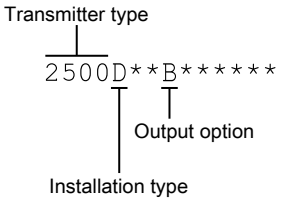


Table 1-2: Installation types for Model 1500 and Model 2500 transmitters

Letter	Description
D	4-wire remote 35 mm DIN rail
B	4-wire remote 35 mm DIN rail with 9-wire remote core processor

1.3 Environmental limits

Table 1-3: Environmental specifications

Type	Value
Ambient temperature limits (Operating)	–40 to +131 °F (–40 to +55 °C)
Ambient temperature limits (Storage)	–40 to +185 °F (–40 to +85 °C)
Humidity limits	5 to 95% relative humidity, non-condensing at 140 °F (60 °C)
Vibration limits	Meets IEC68.2.6, endurance sweep, 5 to 2000 Hz, 50 sweep cycles at 1.0 g
EMI effects	Complies with EMC Directive 2004/108/EC per EN 61326 Industrial Complies with NAMUR NE-21 (22.08.2007)
Ambient temperature effect (analog output option)	On mA output: ±0.005% of span per °C

1.4 Hazardous area classifications

If you plan to mount the transmitter in a hazardous area:

- Verify that the transmitter has the appropriate hazardous area approval. Each transmitter has a hazardous area approval tag attached to the transmitter housing.
- Ensure that any cable used between the transmitter and the sensor meets the hazardous area requirements.

1.5 Power requirements

The transmitter must be connected to a DC voltage source.

- Minimum 19.2 to 28.8 VDC
- 6.3 watts
- Meets Installation (Overvoltage) Category II, Pollution Degree 2 requirements

Figure 1-4: Cable sizing formula

$$M = 19.2\text{V} + (R \times L \times 0.33\text{A})$$

A. *M: minimum supply voltage*
B. *R: cable resistance*
C. *L: cable length*

Table 1-4: Typical power cable resistance at 68 °F (20 °C)

Wire gauge	Resistance
14 AWG	0.0050 Ω/ft
16 AWG	0.0080 Ω/ft
18 AWG	0.0128 Ω/ft
20 AWG	0.0204 Ω/ft
2.5 mm^2	0.0136 Ω/m
1.5 mm^2	0.0228 Ω/m
1.0 mm^2	0.0340 Ω/m
0.75 mm^2	0.0460 Ω/m
0.50 mm^2	0.0680 Ω/m

2 Mounting and sensor wiring for 4-wire remote installations

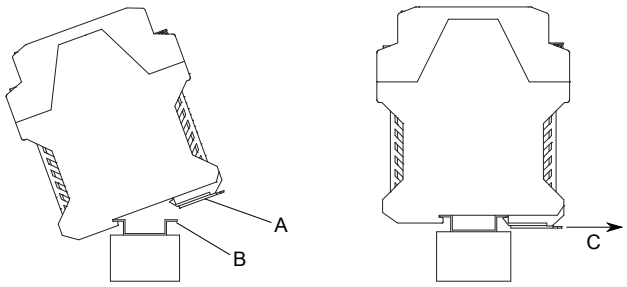
Topics covered in this chapter:

- *Mounting the transmitter to a DIN rail*
- *Prepare the 4-wire cable*
- *Wire the transmitter to the sensor*
- *Ground the flowmeter components*

2.1 Mounting the transmitter to a DIN rail

The transmitter is designed to be mounted on a 35 mm DIN rail. The DIN rail must be grounded.

Figure 2-1: Mounting the transmitter

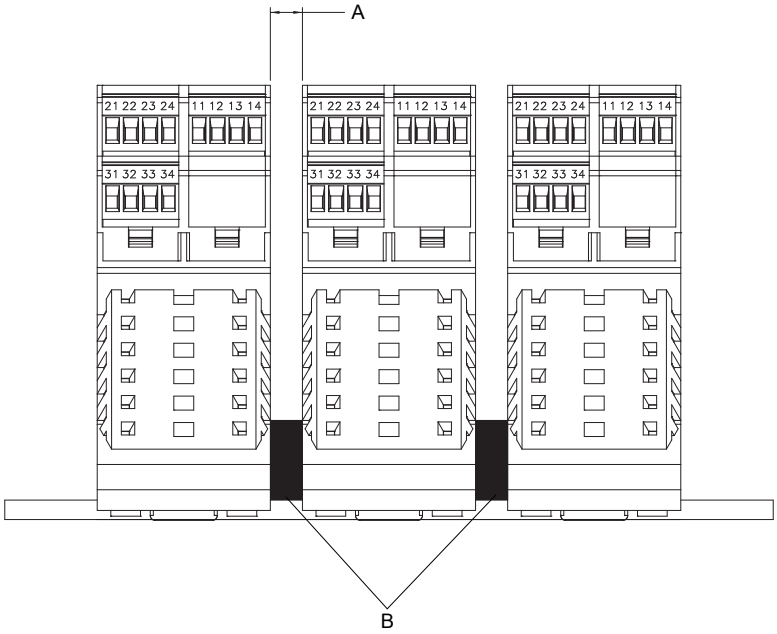


A. Spring clamp
B. DIN rail
C. Spring clamp release loop

2.1.1 Mounting multiple transmitters

If the ambient temperature is above 113 °F (45 °C) and you are mounting multiple transmitters, mount the transmitters so they are at least 0.33 in (8.5 mm) apart.

Figure 2-2: Mounting multiple transmitters



A. 0.33 in or greater (8.5 mm or greater)

B. End bracket or end stop; 0.33 in (8.5 mm) minimum spacing

2.2 Prepare the 4-wire cable

Important

For user-supplied cable glands, the gland must be capable of terminating the drain wires.

Note

If you are installing unshielded cable in continuous metallic conduit with 360º termination shielding, you only need to prepare the cable – you do not need to perform the shielding procedure.

Figure 2-3: 4-wire cable preparation

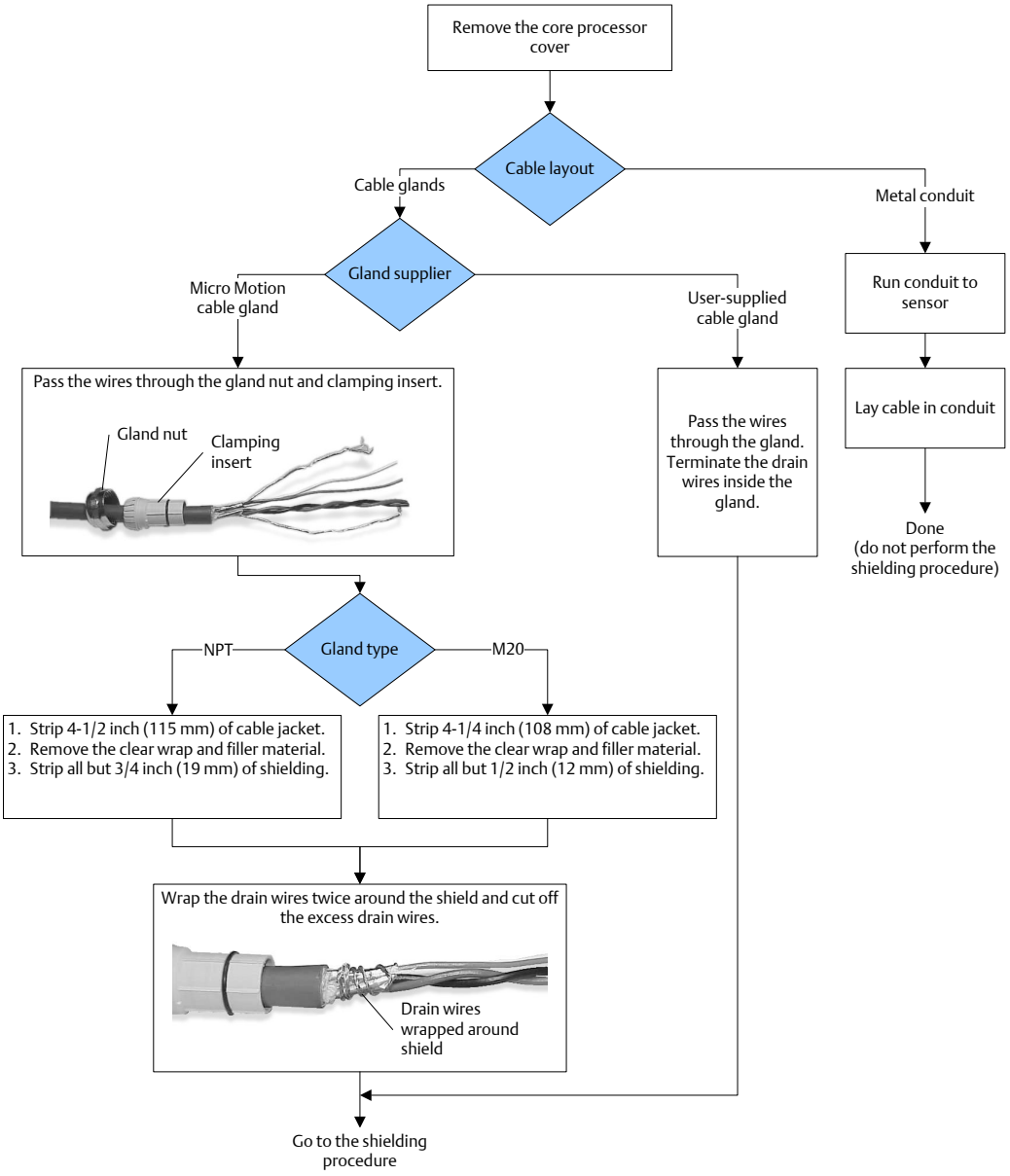
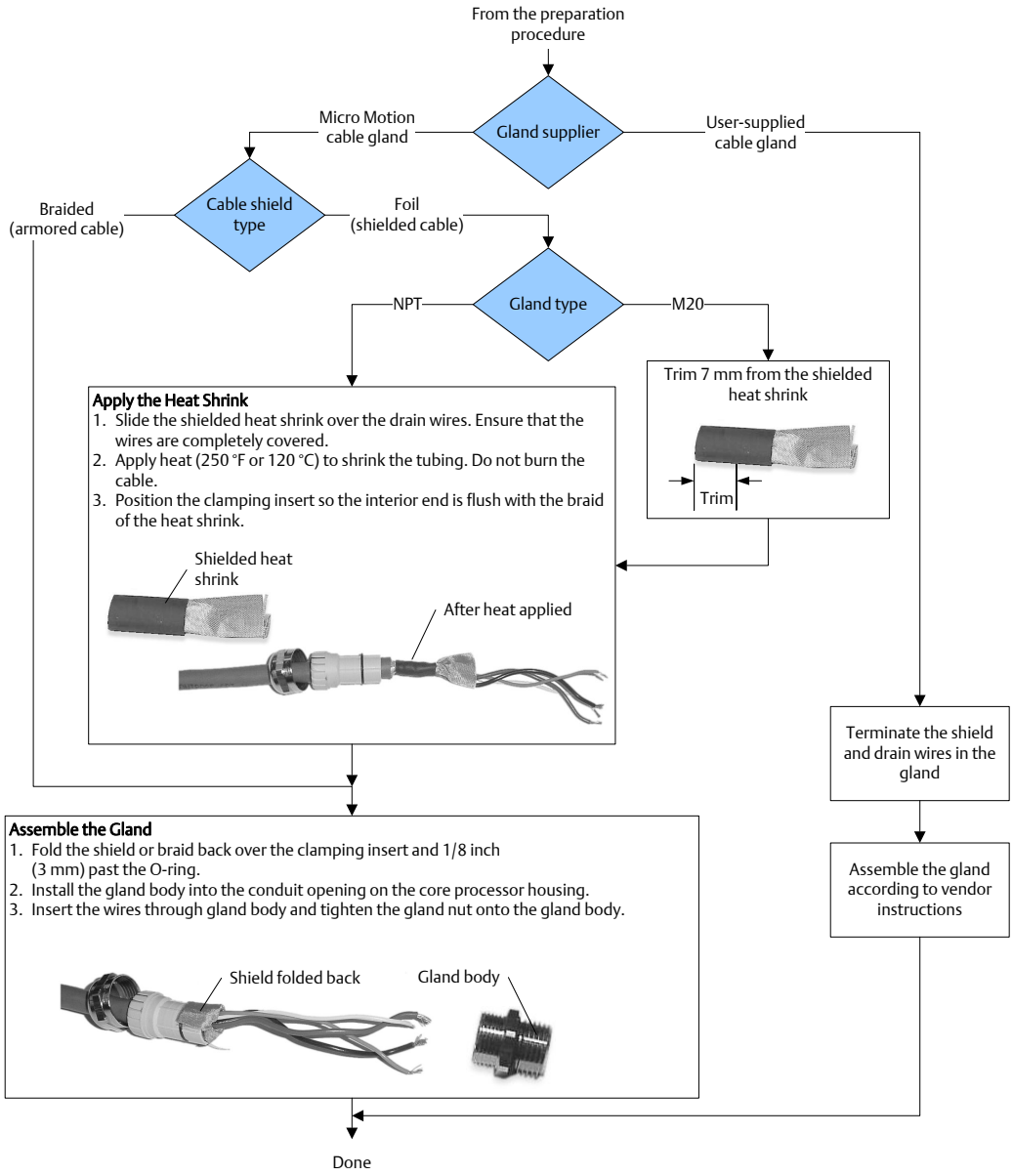

Remove the core processor cover
Cable layout
Cable glands
Metal conduit
Gland supplier
Micro Motion cable gland
User-supplied cable gland
Run conduit to sensor
Pass the wires through the gland nut and clamping insert.
Gland nut
Clamping insert
Pass the wires through the gland. Terminate the drain wires inside the gland.
Lay cable in conduit
Done (do not perform the shielding procedure)
Gland type
NPT
M20
1. Strip 4-1/2 inch (115 mm) of cable jacket.
2. Remove the clear wrap and filler material.
3. Strip all but 3/4 inch (19 mm) of shielding.
1. Strip 4-1/4 inch (108 mm) of cable jacket.
2. Remove the clear wrap and filler material.
3. Strip all but 1/2 inch (12 mm) of shielding.
Wrap the drain wires twice around the shield and cut off the excess drain wires.
Drain wires wrapped around shield
Go to the shielding procedure

Figure 2-4: 4-wire cable shielding


From the preparation procedure
Gland supplier
Micro Motion cable gland
User-supplied cable gland
Cable shield type
Braided (armored cable)
Foil (shielded cable)
Gland type
NPT
M20
Trim 7 mm from the shielded heat shrink
Trim
Apply the Heat Shrink
1. Slide the shielded heat shrink over the drain wires. Ensure that the wires are completely covered.
2. Apply heat (250 °F or 120 °C) to shrink the tubing. Do not burn the cable.
3. Position the clamping insert so the interior end is flush with the braid of the heat shrink.
Shielded heat shrink
After heat applied
Terminate the shield and drain wires in the gland
Assemble the Gland
1. Fold the shield or braid back over the clamping insert and 1/8 inch (3 mm) past the O-ring.
2. Install the gland body into the conduit opening on the core processor housing.
3. Insert the wires through gland body and tighten the gland nut onto the gland body.
Shield folded back
Gland body
Assemble the gland according to vendor instructions
Done

2.2.1 4-wire cable types and usage

Micro Motion offers two types of 4-wire cable: shielded and armored. Both types contain shield drain wires.

The 4-wire cable supplied by Micro Motion consists of one pair of red and black 18 AWG (0.75 mm^2) wires for the VDC connection, and one pair of white and green 22 AWG (0.35 mm^2) wires for the RS-485 connection.

User-supplied 4-wire cable must meet the following requirements:

- Twisted pair construction.
- Applicable hazardous area requirements, if the core processor is installed in a hazardous area.
- Wire gauge appropriate for the cable length between the core processor and the transmitter.

Table 2-1: Wire gauge

Wire gauge	Maximum cable length
VDC 22 AWG (0.35 mm^2)	300 ft (90 m)
VDC 20 AWG (0.5 mm^2)	500 ft (150 m)
VDC 18 AWG (0.8 mm^2)	1000 ft (300 m)
RS-485 22 AWG (0.35 mm^2) or larger	1000 ft (300 m)

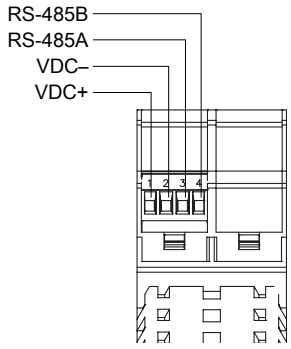
2.3 Wire the transmitter to the sensor

1. Connect the cable to the core processor as described in the sensor documentation.
2. Connect the four wires from the core processor to terminals 1–4 on the transmitter.

Important

Do not ground the shield, braid, or drain wires at the transmitter.

Figure 2-5: Terminal connections for 4-wire cable



2.4 Ground the flowmeter components

In 4-wire remote installations, the transmitter and sensor are grounded separately.

⚠ CAUTION!

Improper grounding could cause inaccurate measurements or flow meter failure. Failure to comply with requirements for intrinsic safety in a hazardous area could result in an explosion.

Note

For hazardous area installations in Europe, refer to standard EN 60079-14 or national standards.

If national standards are not in effect, adhere to the following guidelines for grounding:

- Use copper wire, 14 AWG (2.5 mm^2) or larger wire size.
- Keep all ground leads as short as possible, less than 1 Ω impedance.
- Connect ground leads directly to earth, or follow plant standards.

1. Ground the sensor according to the instructions in the sensor documentation.
2. Ground the DIN rail.

   The rail clip in the base of the transmitter housing grounds the transmitter to the DIN rail.

3 Mounting and sensor wiring for remote core processor with remote sensor installations

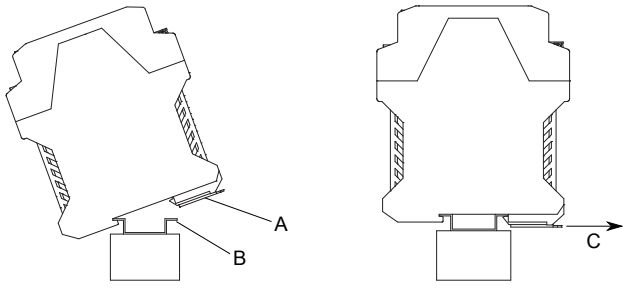
Topics covered in this chapter:

- *Mounting the transmitter to a DIN rail*
- *Mount the remote core processor*
- *Prepare the 4-wire cable*
- *Wire the transmitter to the remote core processor*
- *Prepare the 9-wire cable*
- *Wire the remote core processor to the sensor using jacketed cable*
- *Wire the remote core processor to the sensor using shielded or armored cable*
- *Ground the flowmeter components*

3.1 Mounting the transmitter to a DIN rail

The transmitter is designed to be mounted on a 35 mm DIN rail. The DIN rail must be grounded.

Figure 3-1: Mounting the transmitter

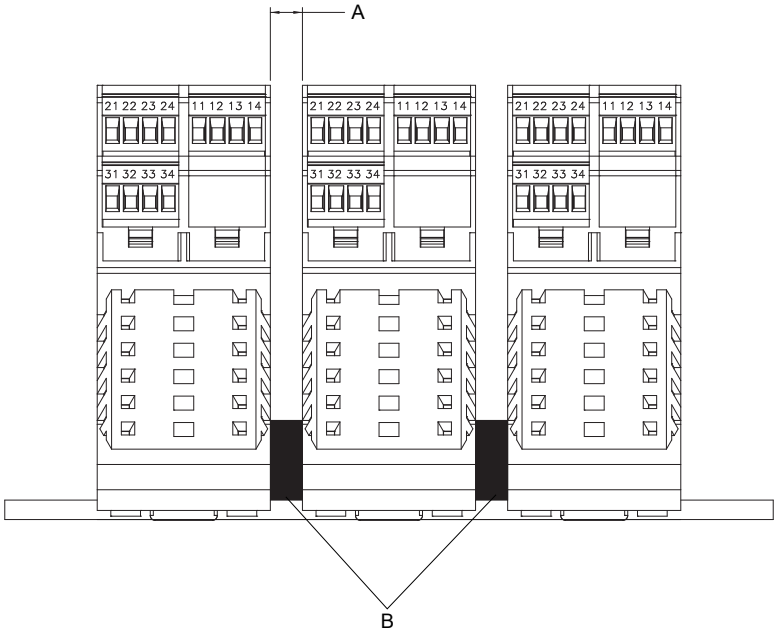


A. Spring clamp
B. DIN rail
C. Spring clamp release loop

3.1.1 Mounting multiple transmitters

If the ambient temperature is above 113 °F (45 °C) and you are mounting multiple transmitters, mount the transmitters so they are at least 0.33 in (8.5 mm) apart.

Figure 3-2: Mounting multiple transmitters



A. 0.33 in or greater (8.5 mm or greater)

B. End bracket or end stop; 0.33 in (8.5 mm) minimum spacing

3.2 Mount the remote core processor

This procedure is required only for remote core processor with remote transmitter installations.

For mounting the remote core processor to a wall:

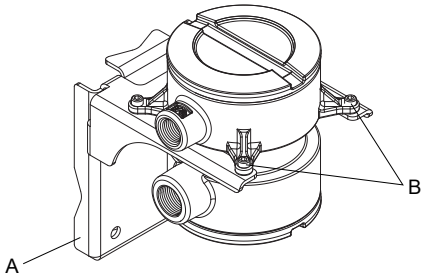
- Use four 5/16-inch diameter (or M8) bolts and nuts that can withstand the process environment. Micro Motion does not supply bolts or nuts (appropriate bolts and nuts are available as an option).
- Ensure that the surface is flat and rigid, does not vibrate, or move excessively.

For mounting the remote core processor to an instrument pole:

- Use two 5/16-inch U-bolts for 2-inch pipe, and four matching nuts, that can withstand the process environment. Micro Motion does not supply U-bolts or nuts.
- Ensure the instrument pole extends at least 12 inches (305 mm) from a rigid base, and is no more than 2 inches (50.8 mm) in diameter.

1. If desired, reorient the core processor housing on the bracket.
   a. Loosen each of the four cap screws (4 mm).
   b. Rotate the bracket so that the core processor is oriented as desired.
   c. Tighten the cap screws, torquing to 30 to 38 in-lbs (3 to 4 N-m).

Figure 3-3: Components of a remote core processor



A. Mounting bracket
B. Cap screws

2. Attach the mounting bracket to an instrument pole or wall.

3.3 Prepare the 4-wire cable

Important

For user-supplied cable glands, the gland must be capable of terminating the drain wires.

Note

If you are installing unshielded cable in continuous metallic conduit with 360º termination shielding, you only need to prepare the cable – you do not need to perform the shielding procedure.

Figure 3-4: 4-wire cable preparation

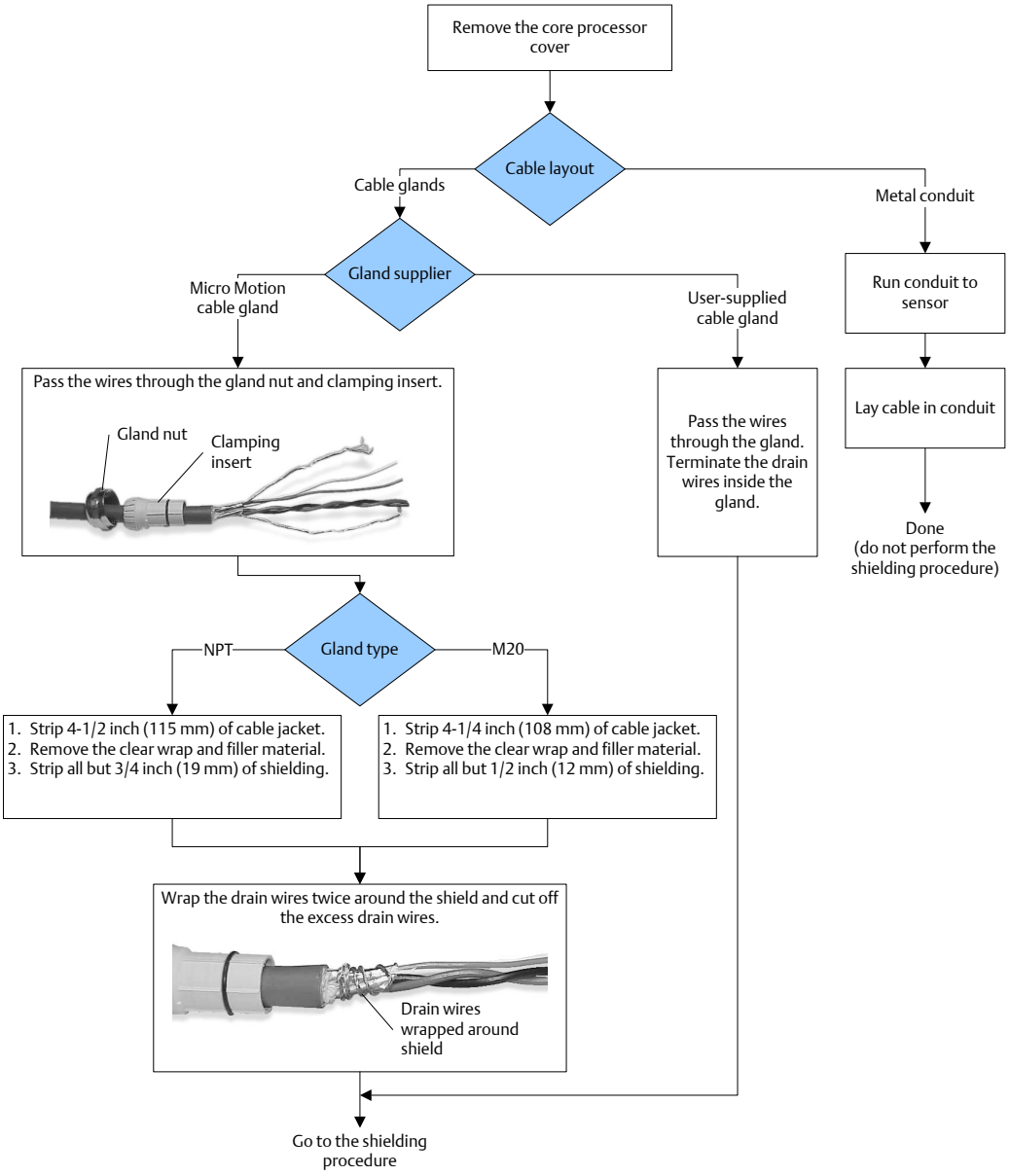
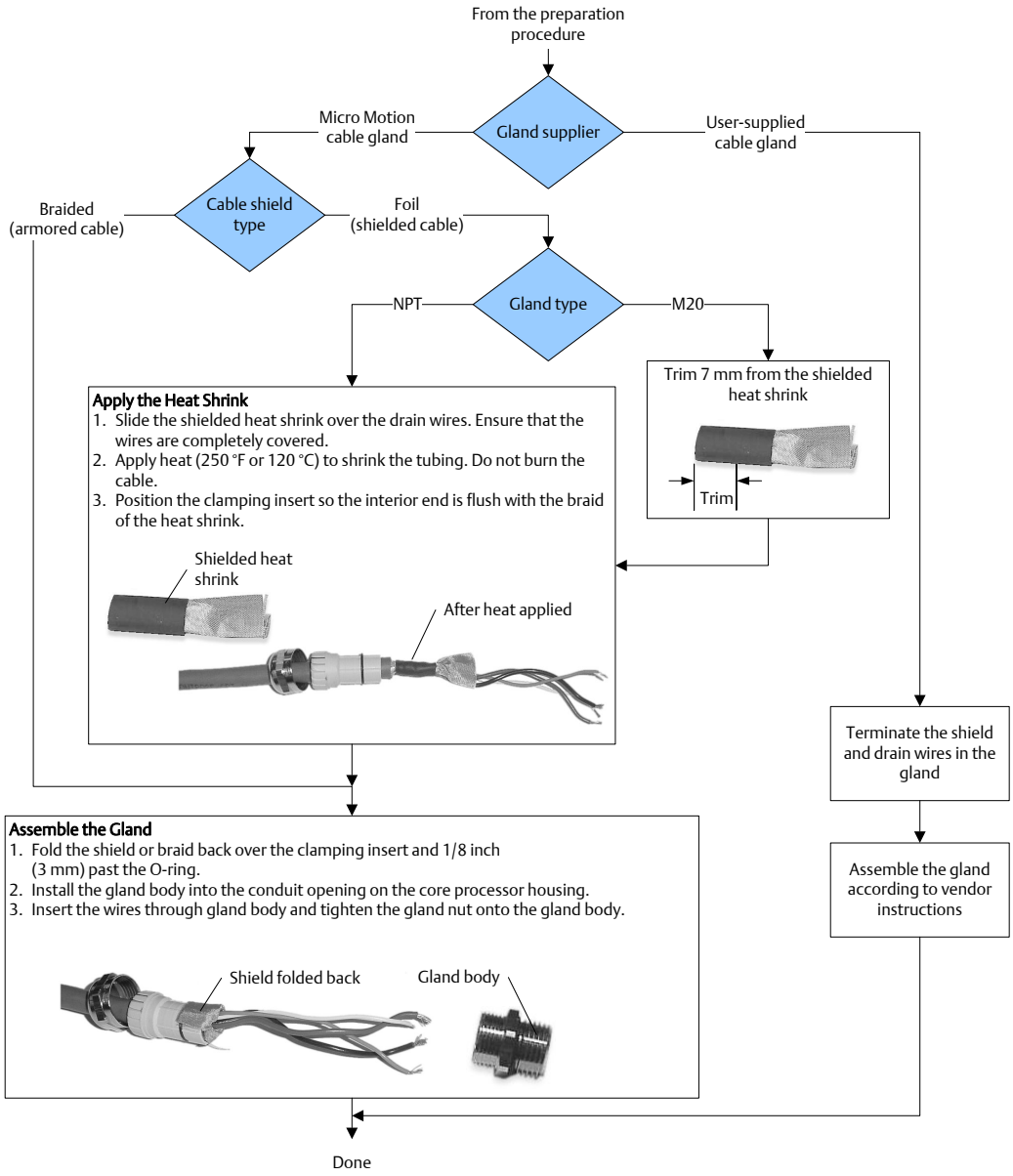

Remove the core processor cover
Cable layout
Cable glands
Metal conduit
Gland supplier
Micro Motion cable gland
User-supplied cable gland
Run conduit to sensor
Pass the wires through the gland nut and clamping insert.
Gland nut
Clamping insert
Pass the wires through the gland. Terminate the drain wires inside the gland.
Lay cable in conduit
Done (do not perform the shielding procedure)
Gland type
NPT
M20
1. Strip 4-1/2 inch (115 mm) of cable jacket.
2. Remove the clear wrap and filler material.
3. Strip all but 3/4 inch (19 mm) of shielding.
1. Strip 4-1/4 inch (108 mm) of cable jacket.
2. Remove the clear wrap and filler material.
3. Strip all but 1/2 inch (12 mm) of shielding.
Wrap the drain wires twice around the shield and cut off the excess drain wires.
Drain wires wrapped around shield
Go to the shielding procedure

Figure 3-5: 4-wire cable shielding


From the preparation procedure
Gland supplier
Micro Motion cable gland
User-supplied cable gland
Cable shield type
Braided (armored cable)
Foil (shielded cable)
Gland type
NPT
M20
Trim 7 mm from the shielded heat shrink
Trim
Apply the Heat Shrink
1. Slide the shielded heat shrink over the drain wires. Ensure that the wires are completely covered.
2. Apply heat (250 °F or 120 °C) to shrink the tubing. Do not burn the cable.
3. Position the clamping insert so the interior end is flush with the braid of the heat shrink.
Shielded heat shrink
After heat applied
Terminate the shield and drain wires in the gland
Assemble the Gland
1. Fold the shield or braid back over the clamping insert and 1/8 inch (3 mm) past the O-ring.
2. Install the gland body into the conduit opening on the core processor housing.
3. Insert the wires through gland body and tighten the gland nut onto the gland body.
Shield folded back
Gland body
Assemble the gland according to vendor instructions
Done

3.3.1 4-wire cable types and usage

Micro Motion offers two types of 4-wire cable: shielded and armored. Both types contain shield drain wires.

The 4-wire cable supplied by Micro Motion consists of one pair of red and black 18 AWG (0.75 mm^2) wires for the VDC connection, and one pair of white and green 22 AWG (0.35 mm^2) wires for the RS-485 connection.

User-supplied 4-wire cable must meet the following requirements:

- Twisted pair construction.
- Applicable hazardous area requirements, if the core processor is installed in a hazardous area.
- Wire gauge appropriate for the cable length between the core processor and the transmitter.

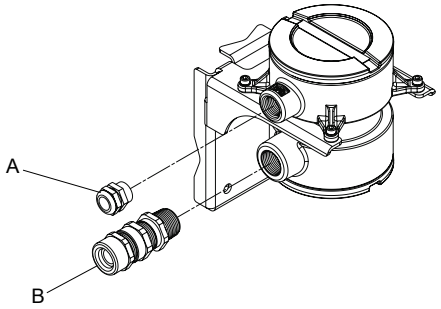
Table 3-1: Wire gauge

Wire gauge	Maximum cable length
VDC 22 AWG (0.35 mm^2)	300 ft (90 m)
VDC 20 AWG (0.5 mm^2)	500 ft (150 m)
VDC 18 AWG (0.8 mm^2)	1000 ft (300 m)
RS-485 22 AWG (0.35 mm^2) or larger	1000 ft (300 m)

3.4 Wire the transmitter to the remote core processor

1. If you are installing a Micro Motion-supplied cable gland at the core processor housing, identify the cable gland to use for the 4-wire cable conduit opening.

Figure 3-6: Cable gland identification

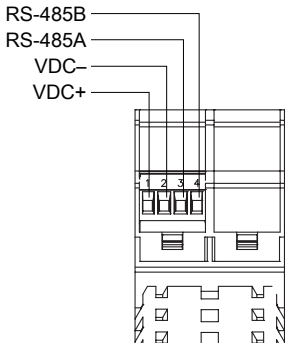


A. Cable gland used with 4-wire conduit opening
B. 3/4"–14 NPT cable gland used with 9-wire conduit opening

2. Connect the cable to the core processor as described in the sensor documentation.
3. Connect the four wires from the core processor to terminals 1–4 on the transmitter.

Important
Do not ground the shield, braid, or drain wires at the transmitter.

Figure 3-7: Terminal connections for 4-wire cable



3.5 Prepare the 9-wire cable

Micro Motion supplies three types of 9-wire cable: jacketed, shielded, and armored. The type of cable you are using determines how you will prepare the cable.

Perform the cable preparation procedure appropriate for your cable type.

Figure 3-8: Preparing jacketed cable

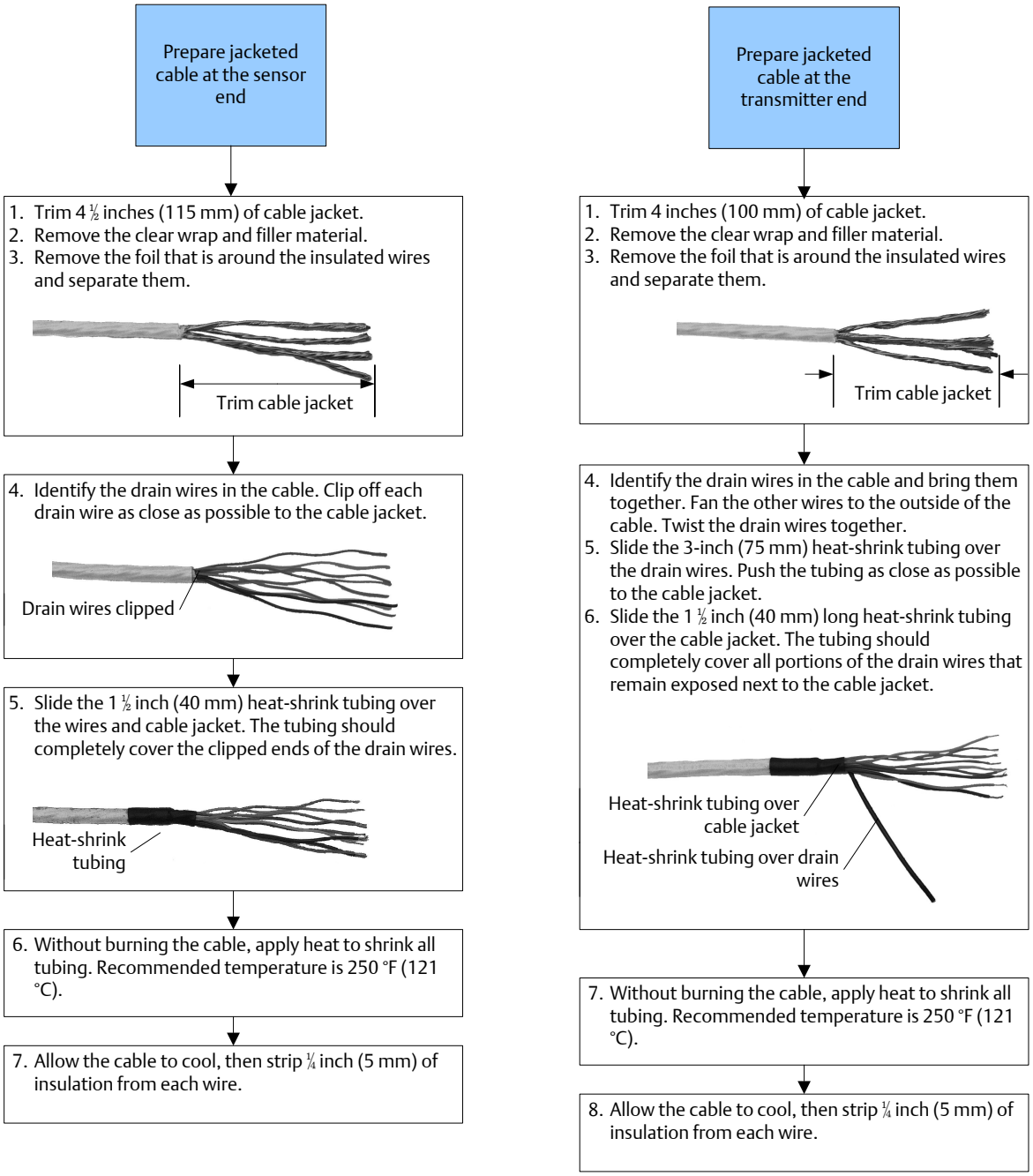
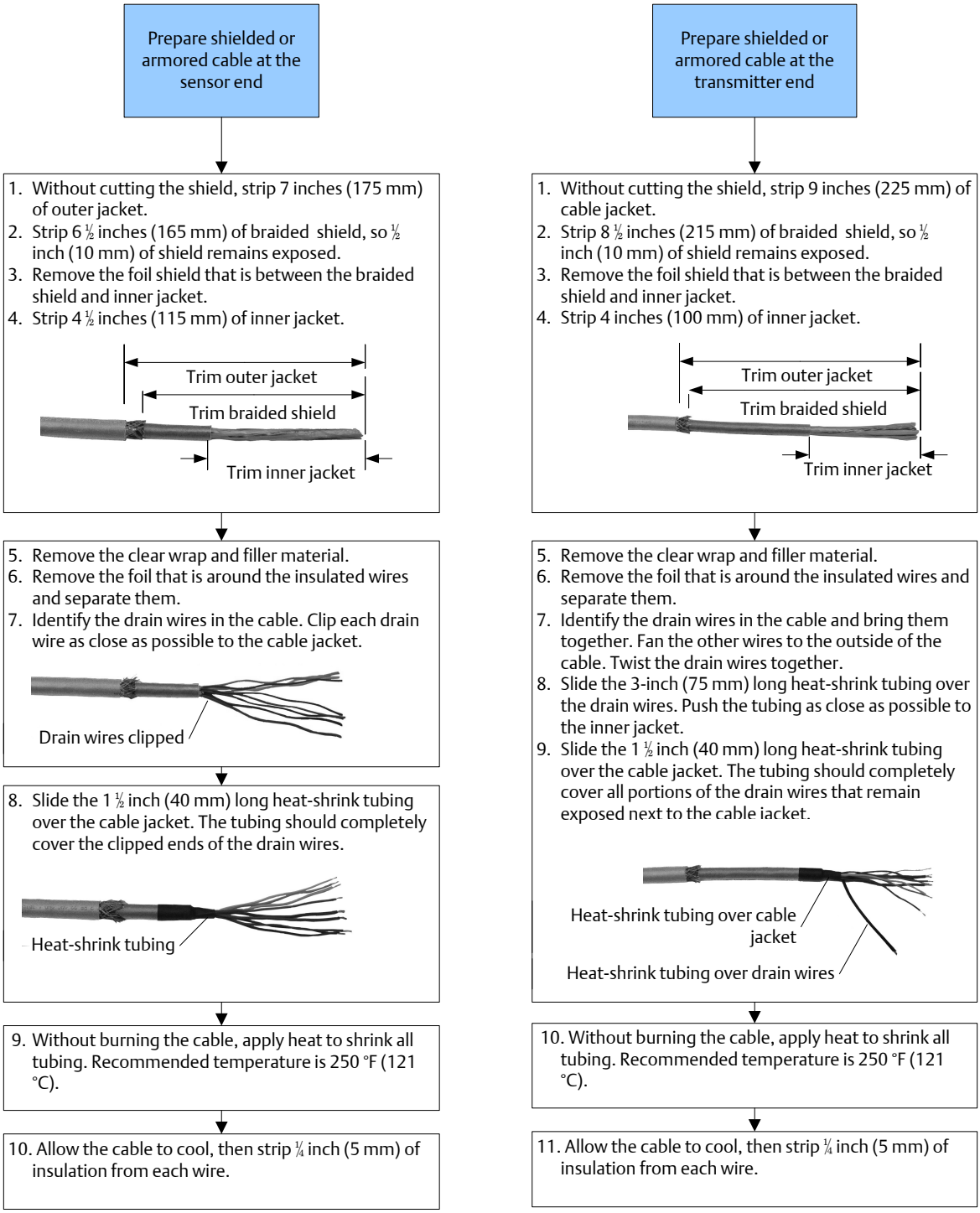

Prepare jacketed cable at the sensor end
1. Trim 4 ½ inches (115 mm) of cable jacket.
2. Remove the clear wrap and filler material.
3. Remove the foil that is around the insulated wires and separate them.
Trim cable jacket
4. Identify the drain wires in the cable. Clip off each drain wire as close as possible to the cable jacket.
Drain wires clipped
5. Slide the 1 ½ inch (40 mm) heat-shrink tubing over the wires and cable jacket. The tubing should completely cover the clipped ends of the drain wires.
Heat-shrink tubing
6. Without burning the cable, apply heat to shrink all tubing. Recommended temperature is 250 °F (121 °C).
7. Allow the cable to cool, then strip ¼ inch (5 mm) of insulation from each wire.
Prepare jacketed cable at the transmitter end
1. Trim 4 inches (100 mm) of cable jacket.
2. Remove the clear wrap and filler material.
3. Remove the foil that is around the insulated wires and separate them.
Trim cable jacket
4. Identify the drain wires in the cable and bring them together. Fan the other wires to the outside of the cable. Twist the drain wires together.
5. Slide the 3-inch (75 mm) heat-shrink tubing over the drain wires. Push the tubing as close as possible to the cable jacket.
6. Slide the 1 ½ inch (40 mm) long heat-shrink tubing over the cable jacket. The tubing should completely cover all portions of the drain wires that remain exposed next to the cable jacket.
Heat-shrink tubing over cable jacket
Heat-shrink tubing over drain wires
7. Without burning the cable, apply heat to shrink all tubing. Recommended temperature is 250 °F (121 °C).
8. Allow the cable to cool, then strip ¼ inch (5 mm) of insulation from each wire.

Figure 3-9: Preparing shielded or armored cable


Prepare shielded or armored cable at the sensor end
1. Without cutting the shield, strip 7 inches (175 mm) of outer jacket.
2. Strip 6 ½ inches (165 mm) of braided shield, so ½ inch (10 mm) of shield remains exposed.
3. Remove the foil shield that is between the braided shield and inner jacket.
4. Strip 4 ½ inches (115 mm) of inner jacket.
Trim outer jacket
Trim braided shield
Trim inner jacket
5. Remove the clear wrap and filler material.
6. Remove the foil that is around the insulated wires and separate them.
7. Identify the drain wires in the cable. Clip each drain wire as close as possible to the cable jacket.
Drain wires clipped
8. Slide the 1 ½ inch (40 mm) long heat-shrink tubing over the cable jacket. The tubing should completely cover the clipped ends of the drain wires.
Heat-shrink tubing
9. Without burning the cable, apply heat to shrink all tubing. Recommended temperature is 250 °F (121 °C).
10. Allow the cable to cool, then strip ¼ inch (5 mm) of insulation from each wire.
Prepare shielded or armored cable at the transmitter end
1. Without cutting the shield, strip 9 inches (225 mm) of cable jacket.
2. Strip 8 ½ inches (215 mm) of braided shield, so ½ inch (10 mm) of shield remains exposed.
3. Remove the foil shield that is between the braided shield and inner jacket.
4. Strip 4 inches (100 mm) of inner jacket.
Trim outer jacket
Trim braided shield
Trim inner jacket
5. Remove the clear wrap and filler material.
6. Remove the foil that is around the insulated wires and separate them.
7. Identify the drain wires in the cable and bring them together. Fan the other wires to the outside of the cable. Twist the drain wires together.
8. Slide the 3-inch (75 mm) long heat-shrink tubing over the drain wires. Push the tubing as close as possible to the inner jacket.
9. Slide the 1 ½ inch (40 mm) long heat-shrink tubing over the cable jacket. The tubing should completely cover all portions of the drain wires that remain exposed next to the cable jacket.
Heat-shrink tubing over cable jacket
Heat-shrink tubing over drain wires
10. Without burning the cable, apply heat to shrink all tubing. Recommended temperature is 250 °F (121 °C).
11. Allow the cable to cool, then strip ¼ inch (5 mm) of insulation from each wire.

3.5.1 9-wire cable types and usage

Cable types

Micro Motion supplies three types of 9-wire cable: jacketed, shielded, and armored. Note the following differences between the cable types:

- Armored cable provides mechanical protection for the cable wires.
- Jacketed cable has a smaller bend radius than shielded or armored cable.
- If ATEX compliance is required, the different cable types have different installation requirements.

Cable jacket types

All cable types can be ordered with a PVC jacket or Teflon® FEP jacket. Teflon FEP is required for the following installation types:

- All installations that include a T-series sensor.
- All installations with a cable length of 250 ft (75 m) or greater, a nominal flow less than 20 percent, and ambient temperature changes greater than +68 °F (+20 °C).

Table 3-2: Cable jacket material and temperature ranges

	Handling temperature		Operating temperature	
Cable jacket material	**Low limit**	**High limit**	**Low limit**	**High limit**
PVC	–4 °F (–20 °C)	+194 °F (+90 °C)	–40 °F (–40 °C)	+221 °F (+105 °C)
Teflon FEP	–40 °F (–40 °C)	+194 °F (+90 °C)	–76 °F (–60 °C)	+302 °F (+150 °C)

Cable bend radii

Table 3-3: Bend radii of jacketed cable

Jacket material	Outside diameter	Minimum bend radii	
		Static (no load) condition	Under dynamic load
PVC	0.415 inches (10 mm)	3–1/8 inches (80 mm)	6–1/4 inches (159 mm)
Teflon FEP	0.340 inches (9 mm)	2–5/8 inches (67 mm)	5–1/8 inches (131 mm)

Table 3-4: Bend radii of shielded cable

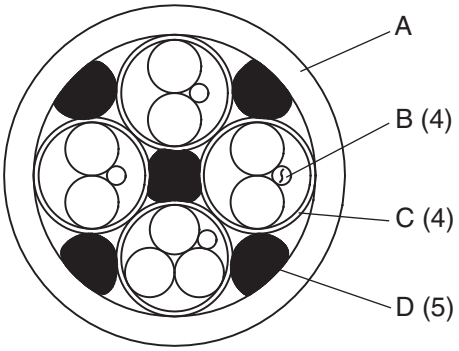
Jacket material	Outside diameter	Minimum bend radii	
		Static (no load) condition	Under dynamic load
PVC	0.2 inches (14 mm)	4–1/4 inches (108 mm)	8–1/2 inches (216 mm)
Teflon FEP	0.425 inches (11 mm)	3–1/4 inches (83 mm)	6–3/8 inches (162 mm)

Table 3-5: Bend radii of armored cable

Jacket material	Outside diameter	Minimum bend radii	
		Static (no load) condition	Under dynamic load
PVC	0.525 inches (14 mm)	4–1/4 inches (108 mm)	8–1/2 inches (216 mm)
Teflon FEP	0.340 inches (9 mm)	3–1/4 inches (83 mm)	6–3/8 inches (162 mm)

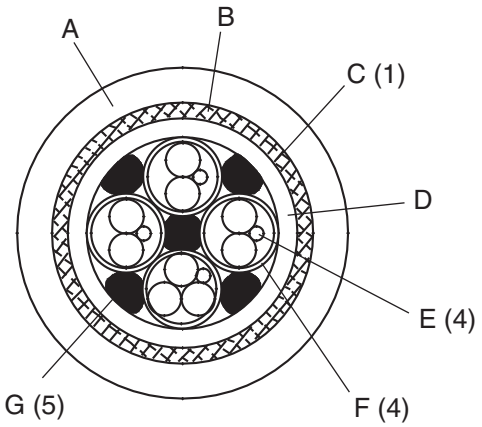
Cable illustrations

Figure 3-10: Cross-section view of jacketed cable



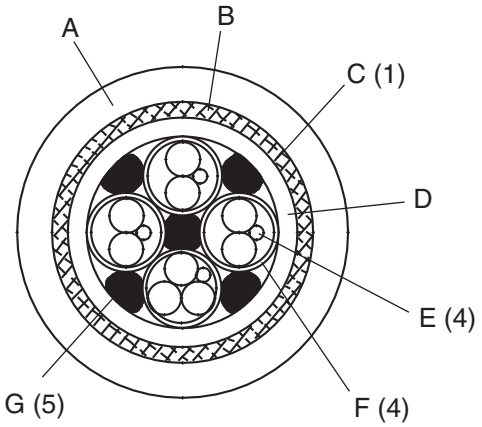
A. Outer jacket
B. Drain wire (4 total)
C. Foil shield (4 total)
D. Filler (5 total)

Figure 3-11: Cross-section view of shielded cable



A. Outer jacket
B. Tin-plated copper braided shield
C. Foil shield (1 total)
D. Inner jacket
E. Drain wire (4 total)
F. Foil shield (4 total)
G. Filler (5 total)

Figure 3-12: Cross-section view of armored cable



A. Outer jacket
B. Stainless steel braided shield
C. Foil shield (1 total)
D. Inner jacket
E. Drain wire (4 total)
F. Foil shield (4 total)
G. Filler (5 total)

3.6 Wire the remote core processor to the sensor using jacketed cable

For ATEX installations, the jacketed cable must be installed inside a user-supplied sealed metallic conduit that provides 360° termination shielding for the enclosed cable.

⚠ CAUTION!

Sensor wiring is intrinsically safe. To keep sensor wiring intrinsically safe, keep the sensor wiring separated from power supply wiring and output wiring.

⚠ CAUTION!

Keep cable away from devices such as transformers, motors, and power lines, which produce large magnetic fields. Improper installation of cable, cable gland, or conduit could cause inaccurate measurements or flow meter failure.

⚠ CAUTION!

Improperly sealed housings can expose electronics to moisture, which can cause measurement error or flowmeter failure. Install drip legs in conduit and cable, if necessary. Inspect and grease all gaskets and O-rings. Fully close and tighten all housing covers and conduit openings.

1. Run the cable through the conduit. Do not install 9-wire cable and power cable in the same conduit.
2. To prevent conduit connectors from seizing in the threads of the conduit openings, apply a conductive anti-galling compound to the threads, or wrap threads with PTFE tape two to three layers deep.

   Wrap the tape in the opposite direction that the male threads will turn when inserted into the female conduit opening.
3. Remove the junction box cover and core processor end-cap.
4. At both the sensor and transmitter, do the following:

   a. Connect a male conduit connector and waterproof seal to the conduit opening for 9-wire.

   b. Pass the cable through the conduit opening for the 9-wire cable.

   c. Insert the stripped end of each wire into the corresponding terminal at the sensor and transmitter ends, matching by color. No bare wires should remain exposed.

Table 3-6: Sensor and remote core processor terminal designations

Wire color	Sensor terminal	Remote core processor terminal	Function
Black	No connection	Ground screw (see note)	Drain wires
Brown	1	1	Drive +
Red	2	2	Drive –

Table 3-6: Sensor and remote core processor terminal designations *(continued)*

Wire color	Sensor terminal	Remote core processor terminal	Function
Orange	3	3	Temperature –
Yellow	4	4	Temperature return
Green	5	5	Left pickoff +
Blue	6	6	Right pickoff +
Violet	7	7	Temperature +
Gray	8	8	Right pickoff –
White	9	9	Left pickoff –

Note

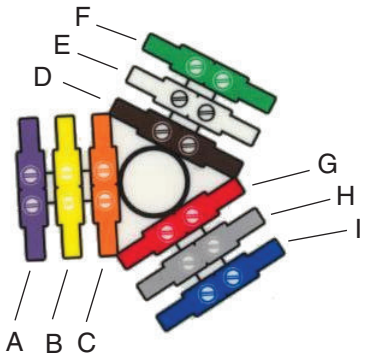
Ground the shield drain wires (the black wire) only on the core processor end, by connecting it to the ground screw inside the lower conduit ring. Never ground to the core processor's mounting screw. Never ground the cable at the sensor junction box.

d. Tighten the screws to hold the wire in place.

e. Ensure integrity of gaskets, grease all O-rings, then replace the junction-box and transmitter housing covers and tighten all screws, as required.

3.6.1 Sensor and remote core processor terminals

Figure 3-13: ELITE, H-Series, T-Series, and some F-Series sensor terminals



A. Violet
B. Yellow
C. Orange
D. Brown
E. White
F. Green
G. Red
H. Gray
I. Blue

Figure 3-14: F-Series, Model D, and Model DL sensor terminals

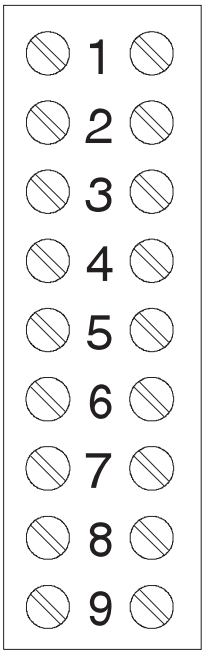
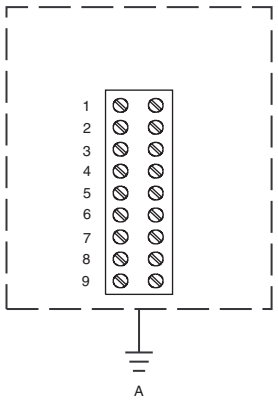
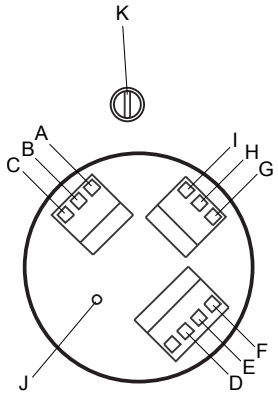


Figure 3-15: Model DT sensor terminals (user-supplied metal junction box with terminal block)



A. Earth ground

Figure 3-16: Remote core processor terminals



A. Brown
B. Violet
C. Yellow
D. Orange
E. Gray
F. Blue
G. White
H. Green
I. Red
J. Mounting screw
K. Ground screw (black)

3.7 Wire the remote core processor to the sensor using shielded or armored cable

For ATEX installations, shielded or armored cable must be installed with cable glands, at both the sensor and remote core processor ends. Cable glands that meet ATEX requirements can be purchased from Micro Motion. Cable glands from other vendors can be used.

⚠ CAUTION!

Keep cable away from devices such as transformers, motors, and power lines, which produce large magnetic fields. Improper installation of cable, cable gland, or conduit could cause inaccurate measurements or flow meter failure.

⚠ CAUTION!

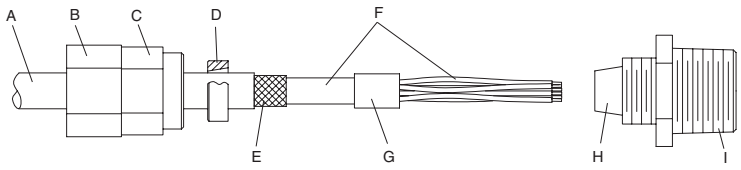
Install cable glands in the 9-wire conduit opening in the transmitter housing and the sensor junction box. Ensure that the cable drain wires and shields do not make contact with the junction box or the transmitter housing. Improper installation of cable or cable glands could cause inaccurate measurements or flow meter failure.

⚠ CAUTION!

Improperly sealed housings can expose electronics to moisture, which can cause measurement error or flowmeter failure. Install drip legs in conduit and cable, if necessary. Inspect and grease all gaskets and O-rings. Fully close and tighten all housing covers and conduit openings.

1. Identify the components of the cable gland and cable.

Figure 3-17: Cable gland and cable (exploded view)

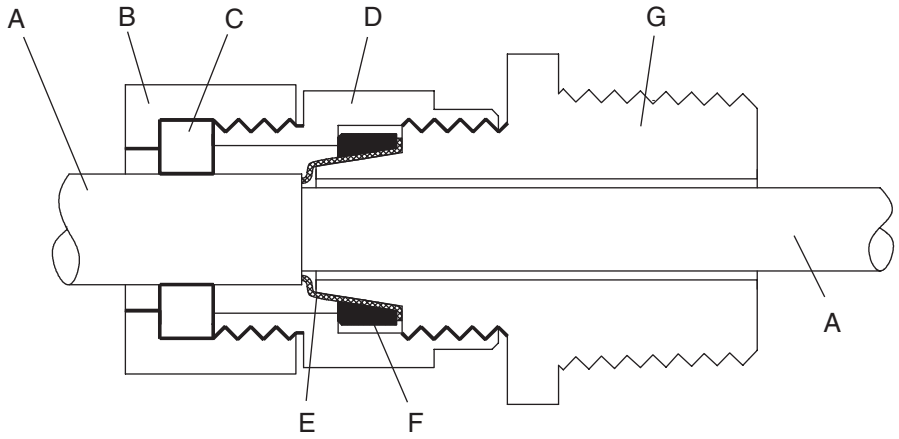


A. Cable
B. Sealing nut
C. Compression nut
D. Brass compression ring
E. Braided shield
F. Cable
G. Tape or heat-shrink tubing
H. Clamp seat (shown as integral to nipple)
I. Nipple

2. Unscrew the nipple from the compression nut.

3. Screw the nipple into the conduit opening for the 9-wire cable. Tighten it to one turn past hand-tight.
4. Slide the compression ring, compression nut, and sealing nut onto the cable. Make sure the compression ring is oriented so the taper will mate properly with the tapered end of the nipple.
5. Pass the cable end through the nipple so the braided shield slides over the tapered end of the nipple.
6. Slide the compression ring over the braided shield.
7. Screw the compression nut onto the nipple. Tighten the sealing nut and compression nut by hand to ensure that the compression ring traps the braided shield.
8. Use a 25-mm (1-inch) wrench to tighten the sealing nut and compression nut to 20–25 foot-pounds (27–34 N-m) of torque.

Figure 3-18: Cross-section of assembled cable gland with cable



A. Cable
B. Sealing nut
C. Seal
D. Compression nut
E. Braided shield
F. Brass compression ring
G. Nipple

9. Remove the junction box cover and remote core processor end-cap.
10. At both the sensor and remote core processor, connect the cable according to the following procedure:

    a. Insert the stripped end of each wire into the corresponding terminal at the sensor and remote core processor ends, matching by color. No bare wires should remain exposed.

Table 3-7: Sensor and remote core processor terminal designations

Wire color	Sensor terminal	Remote core processor terminal	Function
Black	No connection	Ground screw (see notes)	Drain wires
Brown	1	1	Drive +
Red	2	2	Drive –
Orange	3	3	Temperature –
Yellow	4	4	Temperature return
Green	5	5	Left pickoff +
Blue	6	6	Right pickoff +
Violet	7	7	Temperature +
Gray	8	8	Right pickoff –
White	9	9	Left pickoff –

Notes

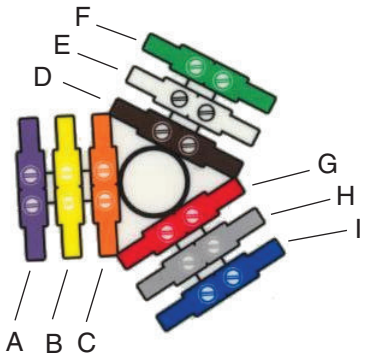
- Ground the shield drain wires (the black wire) only on the remote core processor end, by connecting it to the ground screw inside the lower conduit ring. Never ground to the core processor's mounting screw. Never ground the cable at the sensor junction box.
- Ground the cable braid on both ends, by terminating it inside the cable glands.

b. Tighten the screws to hold the wires in place.

c. Ensure integrity of gaskets, grease all O-rings, then replace the junction box cover and remote core processor end-cap and tighten all screws, as required.

3.7.1 Sensor and remote core processor terminals

Figure 3-19: ELITE, H-Series, T-Series, and some F-Series sensor terminals



A. Violet
B. Yellow
C. Orange
D. Brown
E. White
F. Green
G. Red
H. Gray
I. Blue

Figure 3-20: F-Series, Model D, and Model DL sensor terminals

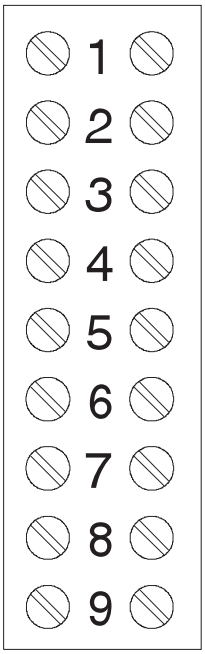
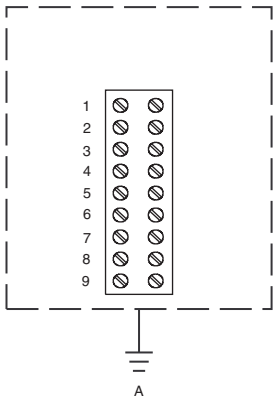
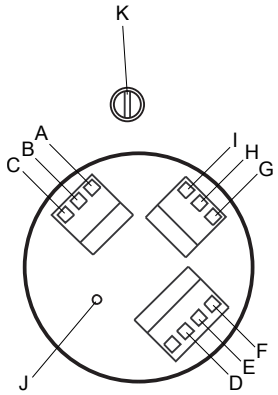


Figure 3-21: Model DT sensor terminals (user-supplied metal junction box with terminal block)



A. Earth ground

Figure 3-22: Remote core processor terminals



A. Brown
B. Violet
C. Yellow
D. Orange
E. Gray
F. Blue
G. White
H. Green
I. Red
J. Mounting screw
K. Ground screw (black)

3.8 Ground the flowmeter components

In a remote core processor with remote sensor installation, the transmitter, remote core processor, and sensor are all grounded separately.

⚠ CAUTION!

Improper grounding could cause inaccurate measurements or flow meter failure. Failure to comply with requirements for intrinsic safety in a hazardous area could result in an explosion.

Note

For hazardous area installations in Europe, refer to standard EN 60079-14 or national standards.

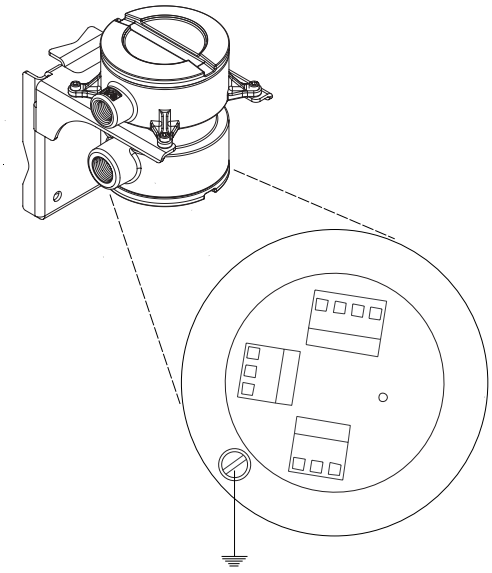
If national standards are not in effect, adhere to the following guidelines for grounding:

- Use copper wire, 14 AWG (2.5 mm^2) or larger wire size.
- Keep all ground leads as short as possible, less than 1 Ω impedance.
- Connect ground leads directly to earth, or follow plant standards.

1. Ground the sensor according to the instructions in the sensor documentation.
2. Ground the DIN rail.

   The rail clip in the base of the transmitter housing grounds the transmitter to the DIN rail.
3. Ground the remote core processor according to applicable local standards, using the remote core processor's internal ground screw.

Figure 3-23: Remote core processor internal ground screw

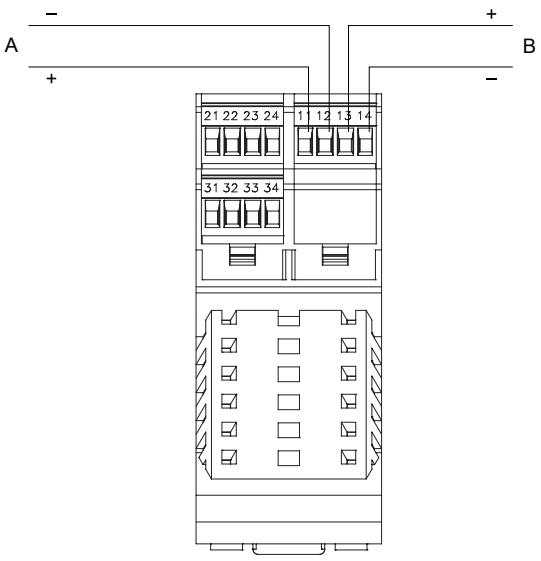


4 Wiring the power supply

4.1 Wire the power supply

Connect the power supply to terminals 11 and 12. Terminals 13 and 14 are used to jumper power to another Model 1500 or Model 2500 transmitter. A maximum of five transmitters can be jumpered together.

Figure 4-1: Power terminals



A. Primary power supply (VDC)

B. Power supply jumper to 1–4 additional Model 1500 or Model 2500 transmitters

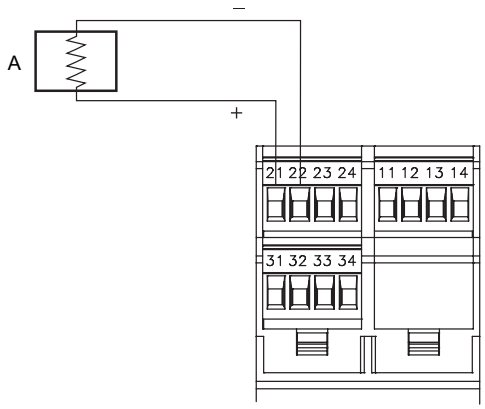
5 I/O wiring for Model 1500 transmitters

Topics covered in this chapter:

- *Basic analog wiring*
- *HART/analog single loop wiring*
- *HART multidrop wiring*

5.1 Basic analog wiring

Figure 5-1: Model 1500 basic analog wiring



A. Terminals 21 and 22 to mA receiving device; 820 Ω maximum loop resistance

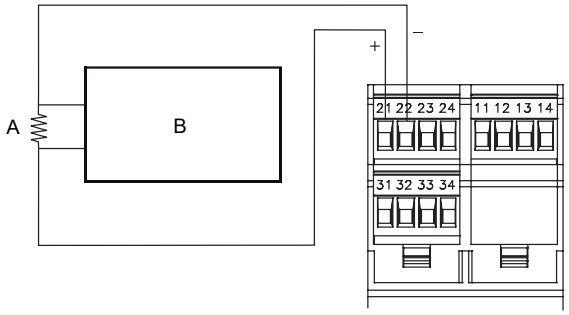
5.2 HART/analog single loop wiring

Note

For HART communications:

- 600 Ω maximum loop resistance
- 250 Ω minimum loop resistance

Figure 5-2: HART/analog single loop wiring



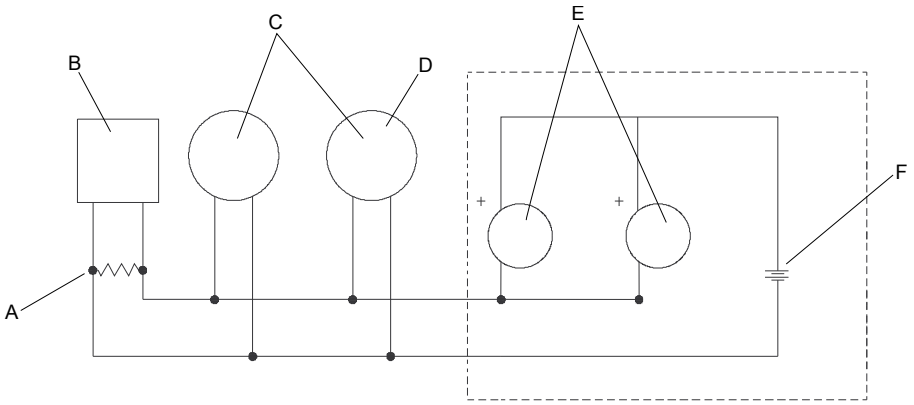
A. 820 Ω maximum loop resistance
B. HART-compatible host or controller

5.3 HART multidrop wiring

Tip

For optimum HART communication, single-point ground the output loop to an instrument-grade ground.

Figure 5-3: HART multidrop wiring



A. 250–600 Ω resistance
B. HART-compatible host or controller
C. HART-compatible transmitters
D. Model 1500 or Model 2500 transmitter
E. SMART FAMILY™ transmitters
F. 24 VDC loop power supply required for passive transmitters

6 I/O wiring for Model 2500 transmitters

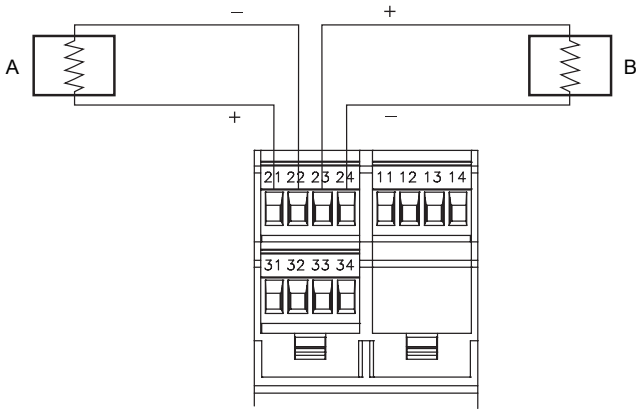
Topics covered in this chapter:

- *mA/HART wiring*
- *Frequency output wiring*
- *Discrete output wiring*
- *Discrete input wiring*

6.1 mA/HART wiring

6.1.1 Basic analog wiring

Figure 6-1: Model 2500 basic analog wiring



A. Channel A – Terminals 21 and 22 to mA receiving device; 820 Ω maximum loop resistance
B. Channel B – Terminals 23 and 24 to mA receiving device; 420 Ω maximum loop resistance

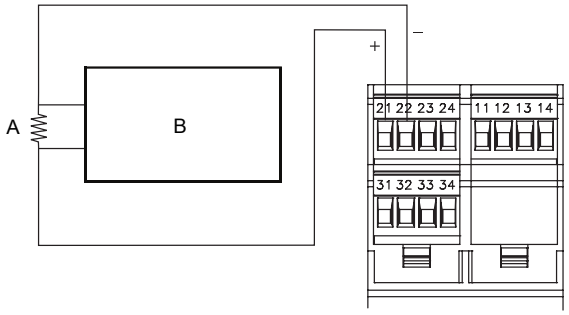
6.1.2 HART/analog single loop wiring

Note

For HART communications:

- 600 Ω maximum loop resistance
- 250 Ω minimum loop resistance

Figure 6-2: HART/analog single loop wiring



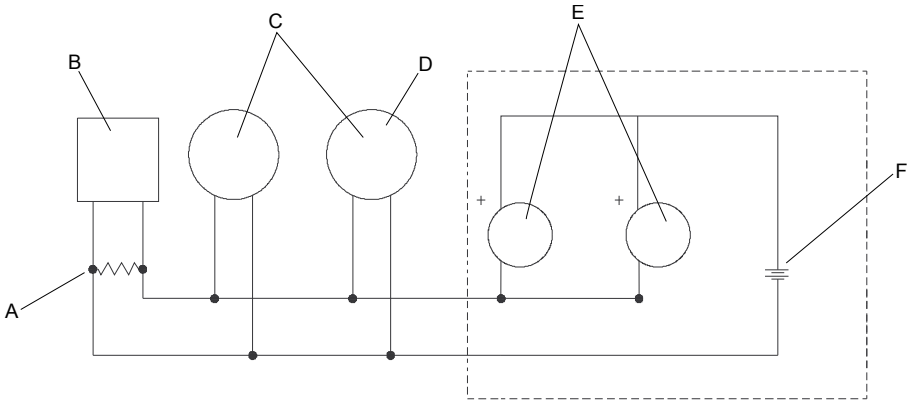
A. 820 Ω maximum loop resistance
B. HART-compatible host or controller

6.1.3 HART multidrop wiring

Tip

For optimum HART communication, single-point ground the output loop to an instrument-grade ground.

Figure 6-3: HART multidrop wiring

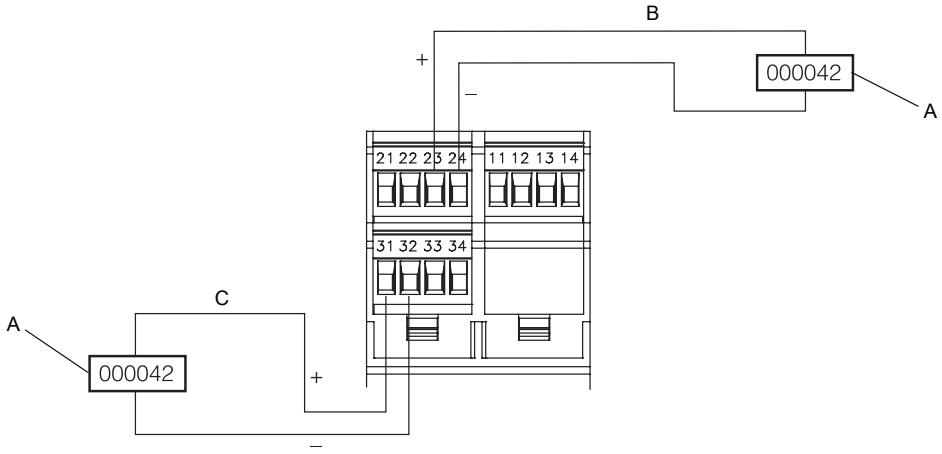


A. 250–600 Ω resistance
B. HART-compatible host or controller
C. HART-compatible transmitters
D. Model 1500 or Model 2500 transmitter
E. SMART FAMILY™ transmitters
F. 24 VDC loop power supply required for passive transmitters

6.2 Frequency output wiring

6.2.1 Internally powered frequency output wiring

Figure 6-4: Internally powered frequency output wiring



A. Counter
B. Channel B – Terminals 23 and 24
C. Channel C – Terminals 31 and 32

Figure 6-5: Output voltage versus load resistance (Channel B)

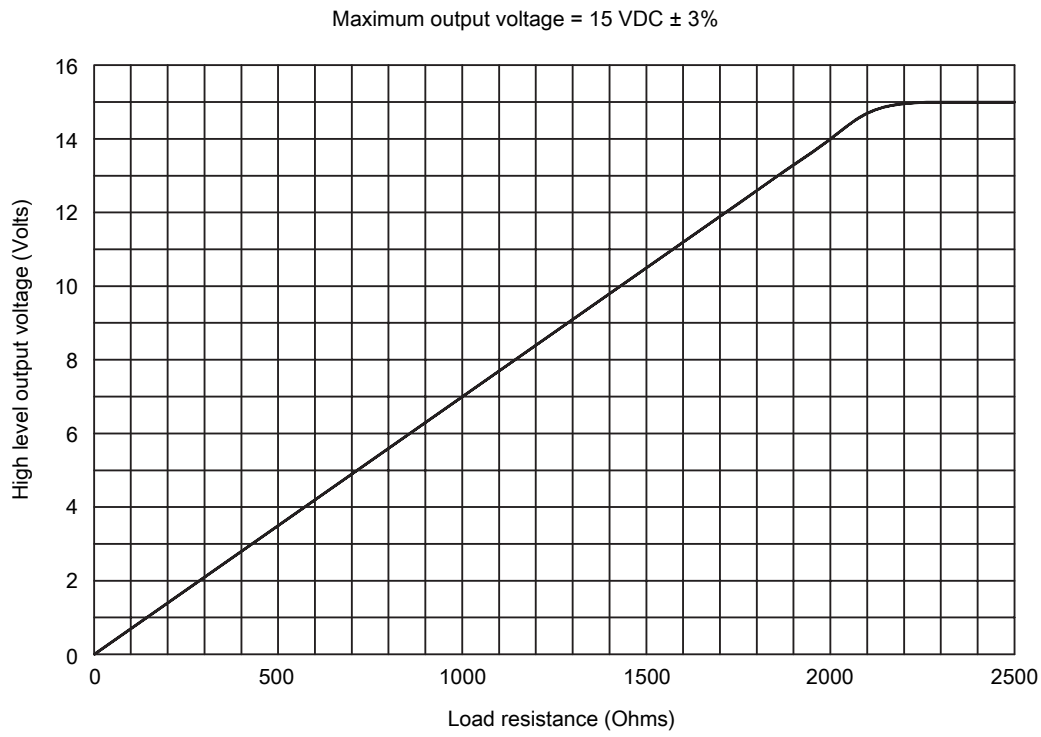
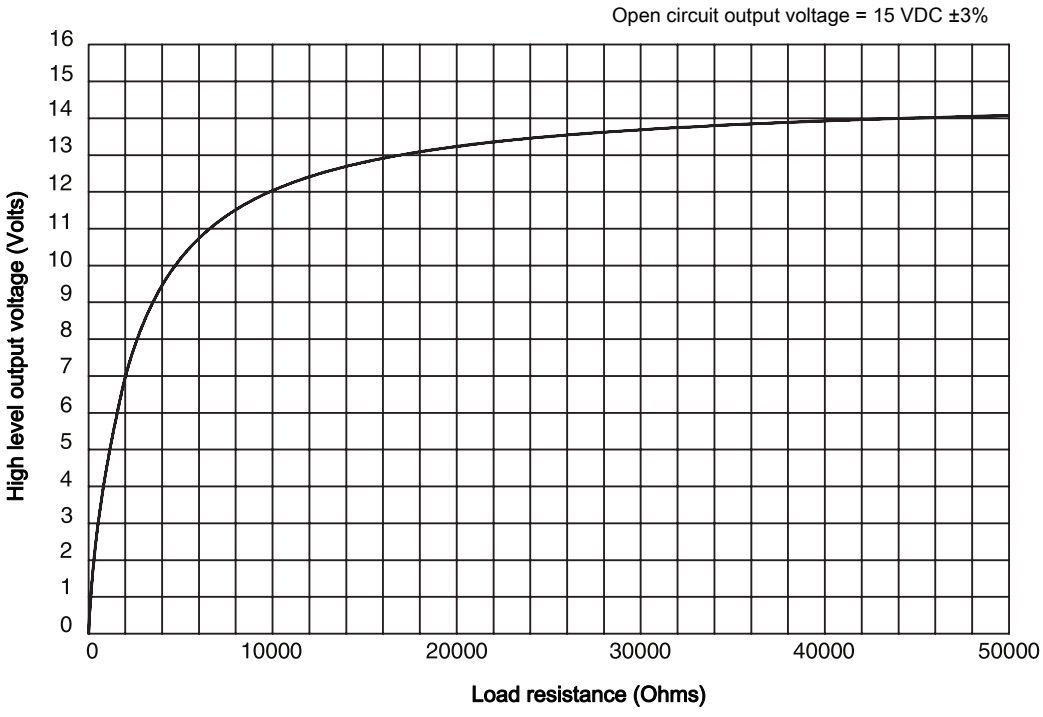
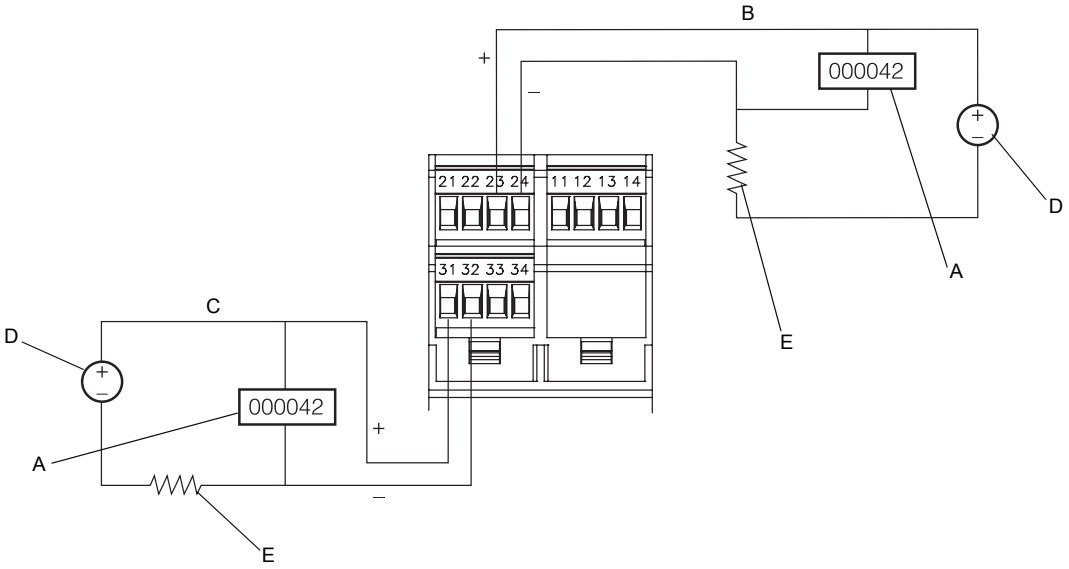


Figure 6-6: Output voltage versus load resistance (Channel C)



6.2.2 Externally powered frequency output wiring

Figure 6-7: Externally powered frequency output wiring

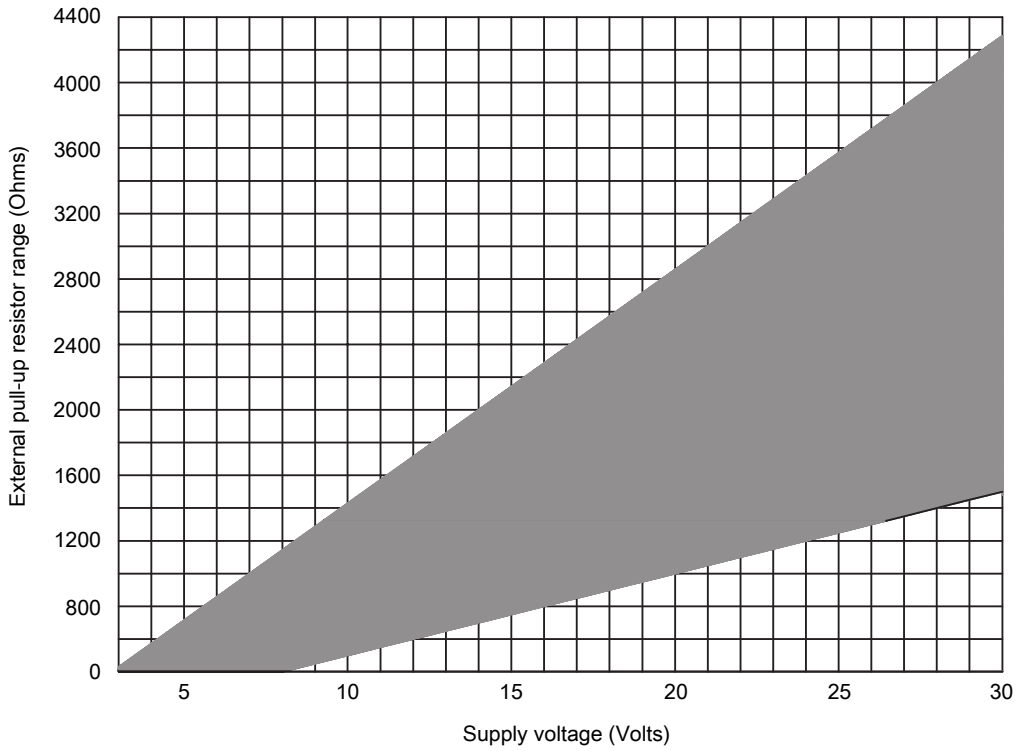


A. Counter
B. Channel B – Terminals 23 and 24
C. Channel C – Terminals 31 and 32
D. 3–30 VDC
E. Pull-up reisistor

⚠ CAUTION!

Exceeding 30 VDC can damage the transmitter. Terminal current must be less than 500 mA.

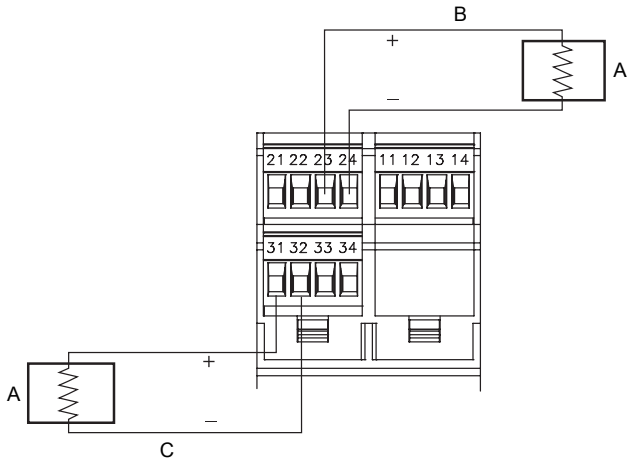
Figure 6-8: Recommended pull-up resistor versus supply voltage



6.3 Discrete output wiring

6.3.1 Internally powered discrete output wiring

Figure 6-9: Internally powered discrete output wiring



A. Discrete output receiving device
B. Channel B (DO1) – Terminals 23 and 24
C. Channel C (DO2) – Terminals 31 and 32

Figure 6-10: Output voltage versus load resistance (Channel B)

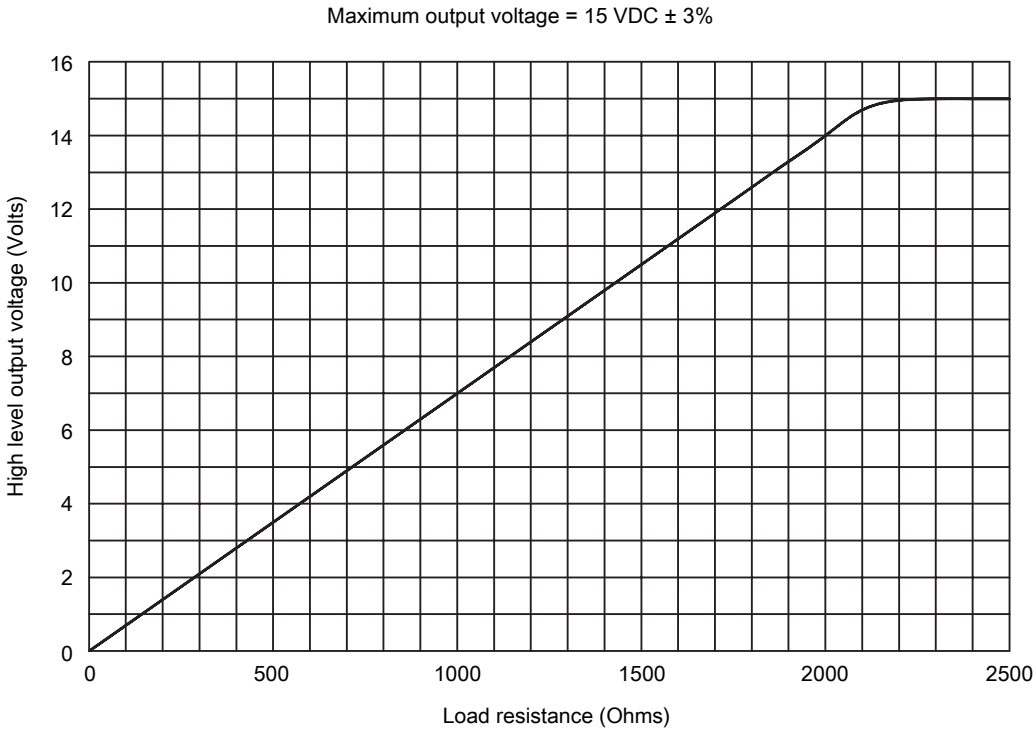
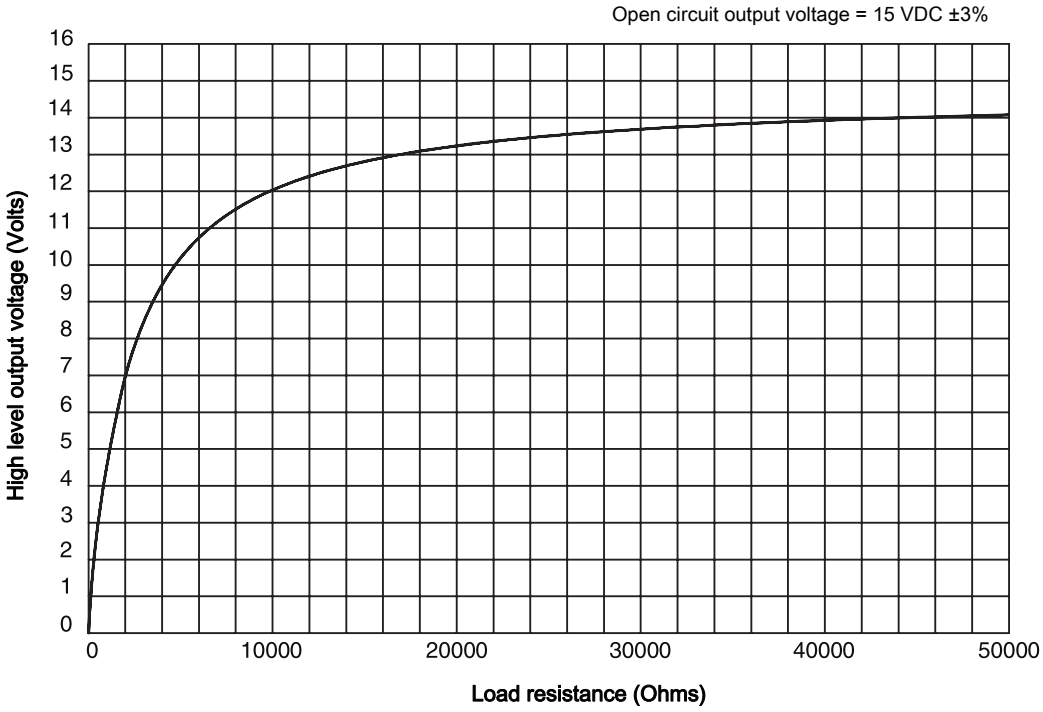
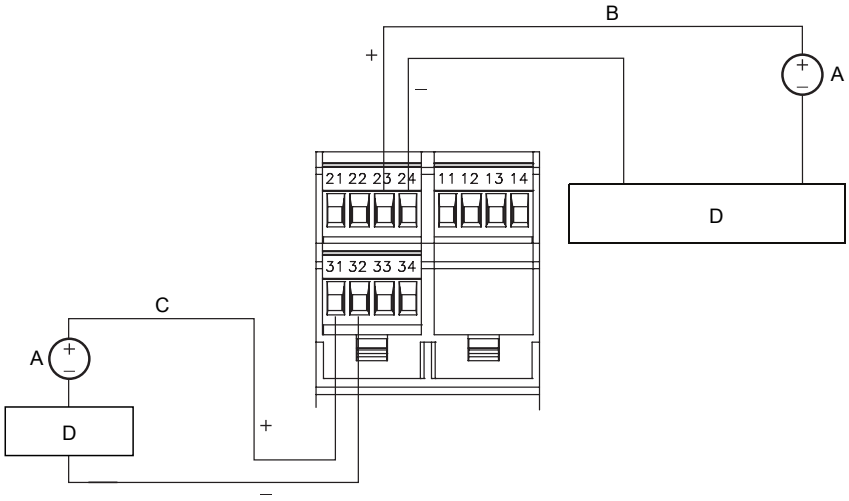


Figure 6-11: Output voltage versus load resistance (Channel C)



6.3.2 Externally powered discrete output wiring

Figure 6-12: Externally powered discrete output wiring

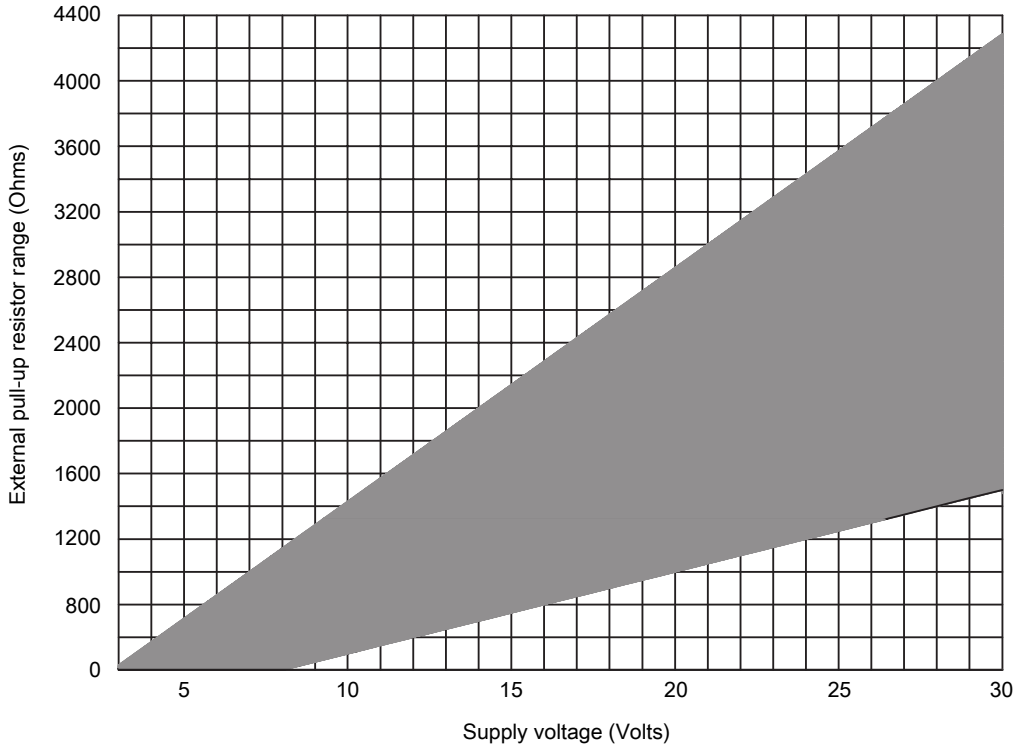


A. 3–30 VDC
B. Channel B (DO1) – Terminals 23 and 24
C. Channel C (DO2) – Terminals 21 and 32
D. Pull-up register or DC relay

⚠ CAUTION!

Exceeding 30 VDC can damage the transmitter. Terminal current must be less than 500 mA.

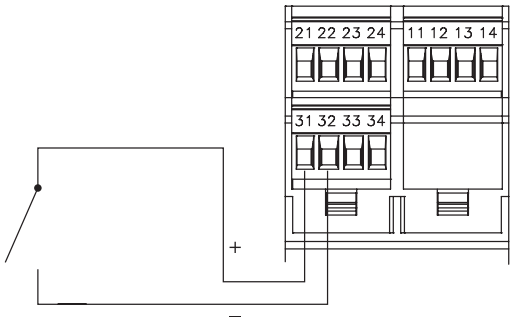
Figure 6-13: Recommended pull-up resistor versus supply voltage



6.4 Discrete input wiring

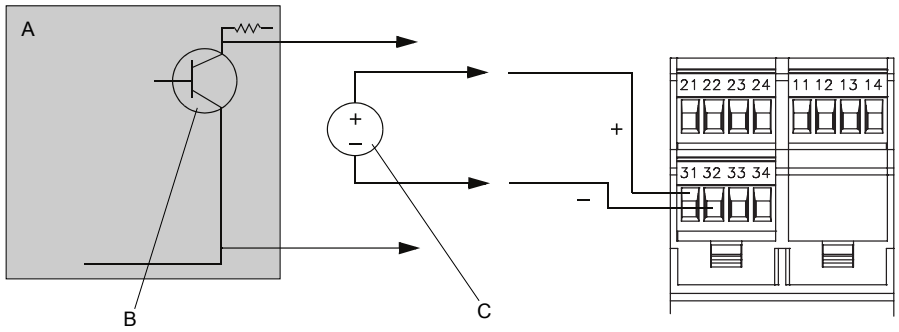
6.4.1 Internally powered discrete input wiring

Figure 6-14: Internally powered discrete input wiring



6.4.2 Externally powered discrete input wiring

Figure 6-15: Externally powered discrete input wiring



A. PLC or other device
B. VDC
C. Direct DC input

Power is supplied by either a PLC/other device or by direct DC input.

Table 6-1: Input voltage ranges for external power

VDC	Range
3–30	High level
0–0.8	Low level
0.8–3	Undefined

7 Specifications

Topics covered in this chapter:

- *Electrical connections*
- *Input/output signals*
- *Environmental limits*
- *Physical specifications*

7.1 Electrical connections

Table 7-1: Electrical connections

Type	Descriptions
Input/output connections	Three pairs of wiring terminals for transmitter outputs. Screw terminals accept stranded or solid conductors, 24 to 12 AWG (0.40 to 3.5 mm^2).
Power connections	The transmitter has two pairs of terminals for the power connection: • Either pair accepts DC power • The remaining pair is used for making a jumper connection to a second transmitter Plug terminals accept solid or stranded conductors, 24 to 12 AWG (0.40 to 3.5 mm^2).
Digital communications maintenance connections	Two clips for temporary connection to the service port. One pair of terminals supports Modbus/RS-485 signal or service port mode. On device power-up, user has 10 seconds to connect in service port mode. After 10 seconds, the terminals default to Modbus/RS-485 mode.
Core processor connection	The transmitter has two pairs of terminals for the 4-wire connection to the core processor: • One pair is used for the RS-485 connection to the core processor • One pair is used to supply power to the core processor Plug terminals accept solid or stranded conductors, 24 to 12 AWG (0.40 to 3.5 mm^2).

7.2 Input/output signals

Table 7-2: Input/output signals – Model 1500

Type	Description
Output variables	• Mass flow • Volume flow
Inputs/outputs	• One active 4–20 mA output • One active frequency output • Zero button, to initiate flowmeter zero calibration
HART	Bell 202 signal is superimposed on the primary milliamp output

Table 7-3: Input/output signals – Model 2500

Type	Description
Output variables	• Mass & volume flow • Net product content / flow • Temperature • Density • Concentration
Inputs/outputs	• One or two active 4–20 mA outputs • One active or passive frequency output • One or two discrete outputs • One discrete input • Zero button, to initiate flowmeter zero calibration
HART	Bell 202 signal is superimposed on the primary milliamp output

7.3 Environmental limits

Table 7-4: Environmental specifications

Type	Value
Ambient temperature limits (Operating)	–40 to +131 °F (–40 to +55 °C)
Ambient temperature limits (Storage)	–40 to +185 °F (–40 to +85 °C)
Humidity limits	5 to 95% relative humidity, non-condensing at 140 °F (60 °C)
Vibration limits	Meets IEC68.2.6, endurance sweep, 5 to 2000 Hz, 50 sweep cycles at 1.0 g
EMI effects	Complies with EMC Directive 2004/108/EC per EN 61326 Industrial Complies with NAMUR NE-21 (22.08.2007)
Ambient temperature effect (analog output option)	On mA output: ±0.005% of span per °C

7.4 Physical specifications

Figure 7-1: Transmitter dimensions

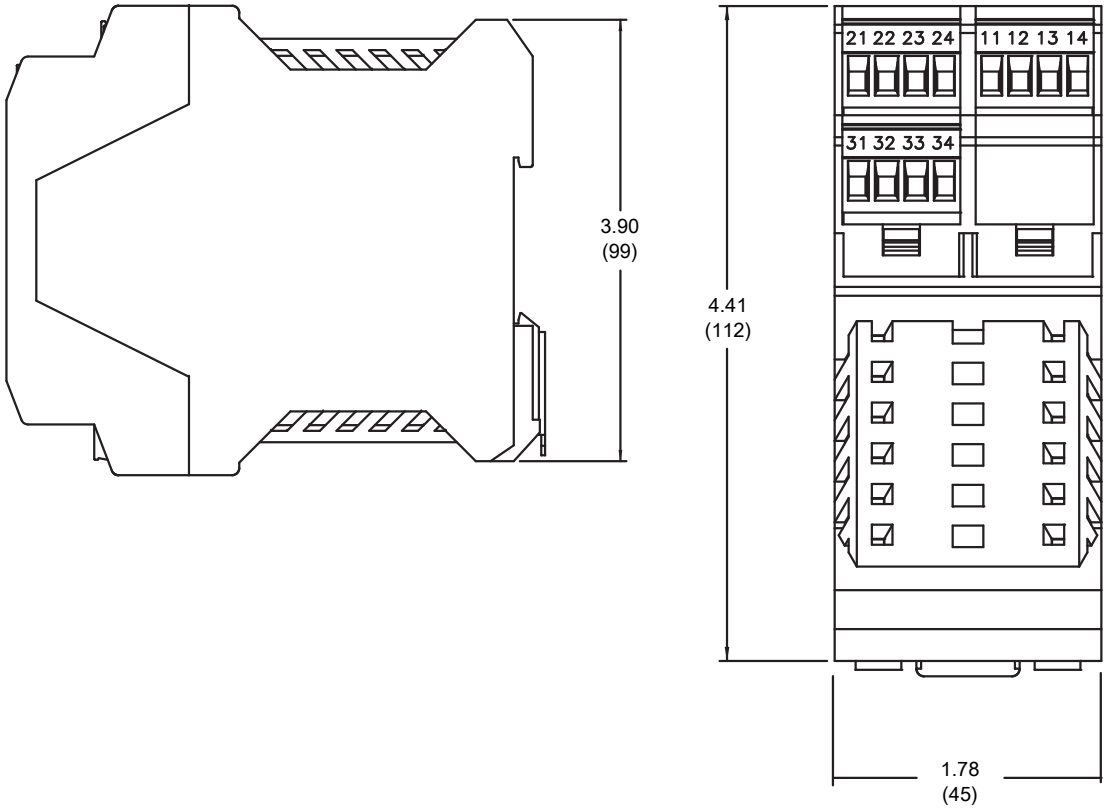
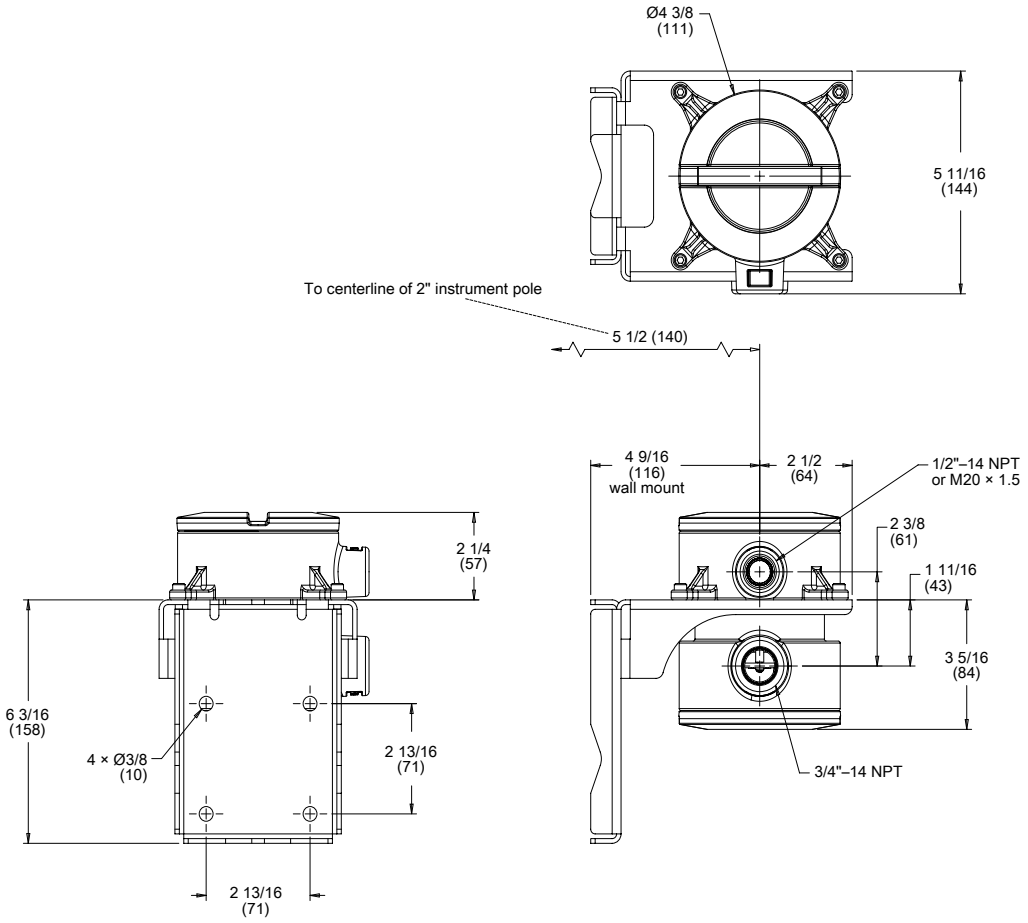


Figure 7-2: Remote core processor dimensions



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